

#### **COVER**

**EDITOR'S NOTE** 

1. WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

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1.1 WESTERN NORTH PACIFIC OCEAN TROPICAL CYCLONES

1.2 NORTH INDIAN OCEAN TROPICAL CYCLONES

1.3 SUMMARY OF WESTERN NORTH
PACIFIC AND NORTH INDIAN OCEAN
TROPICAL CYCLONES

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TS 01W Yanyan

TY 02W Kujira

TD 03W

TY 04W Chan-Hom

TS 05W Linfa

TS 06W Nangka

TY 07W Soudelor

TY 08W Koni

STY 09W Imbudo

TY 10W Morakot

TY 11W Etau

TY 12W Krovanh

TS 13W Vamco

### 2003

## **Annual Tropical Cyclone Report**

U.S. Naval Pacific Meteorology and Oceanography Center/ Joint Typhoon Warning Center

Pearl Harbor, Hawaii



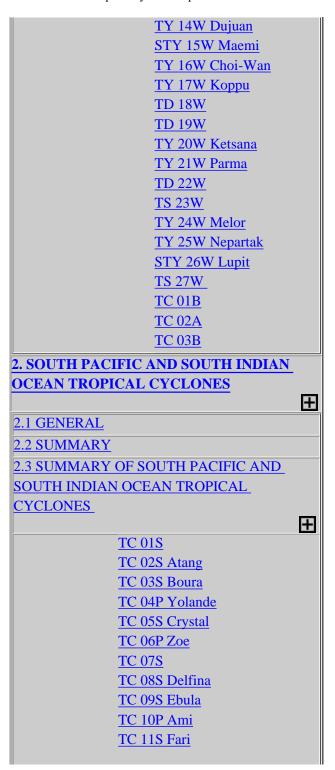
Stiched MODIS true color image of four tropical cyclones in the South Indian Ocean on 12 February 2003 taken between 0400Z and 1010Z. From west to east, TC 16S (Gerry), TC 17S (Hape), TC 18S (Isha) and TC 14S (Fiona). Image courtesy of MODIS Rapid Response Team, NASA Goddard Space Flight Center.

Completed by Direction of:

#### **Peter Furze**

Captain, United States Navy

**Commanding Officer** 



| Amanda Preble                               | $\top$ |
|---|--------|
| Lieutenant Colonel, United States Air Force |        |
| Director, Joint Typhoon Warning Center      |        |
| LT A. C. (Christy) Bryant, USN - Editor     |        |

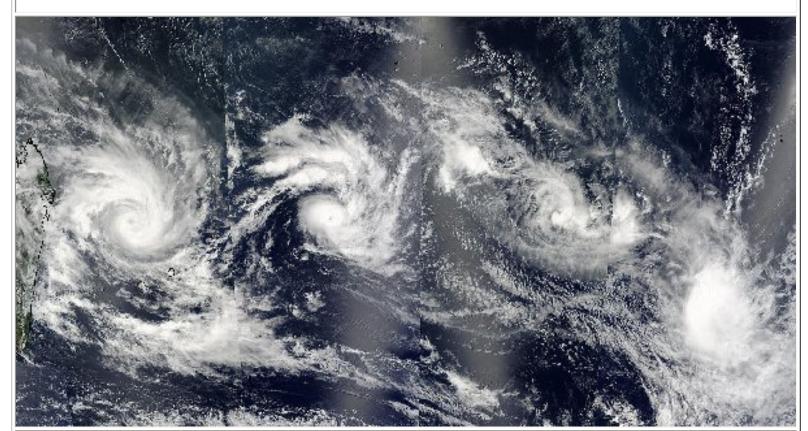
| TC 12P Beni                      |       |
|----------------------------------|-------|
| TC 13P Cilla                     |       |
| TC 14S Fiona                     |       |
| TC 15P Dovi                      |       |
| TC 16S Gerry                     |       |
| TC 17S Hape                      |       |
| TC 18S Isha                      |       |
| TC 19S Japhet                    |       |
| TC 20S Graham                    |       |
| TC 21S Harriet                   |       |
| TC 22P Erica                     |       |
| TC 23S Kalunde                   |       |
| TC 24S Craig                     |       |
| TC 25P Eseta                     |       |
| TC 26S Inigo                     |       |
| TC 27P Fili                      |       |
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| 4.2 TESTING AND RESULTS          |       |
| <u> </u>                         |       |

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Stiched MODIS true color image of four tropical cyclones in the South Indian Ocean on 12 February 2003 taken between 0400Z and 1010Z. From west to east, TC 16S (Gerry), TC 17S (Hape), TC 18S (Isha) and TC 14S (Fiona). Image courtesy of MODIS Rapid Response Team, NASA Goddard Space Flight Center.

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## **Peter Furze**

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## **Amanda Preble**

| Lieutenant Colonel, United States Air Force |  |
|---|--|
| Director, Joint Typhoon Warning Center      |  |
| LT A. C. (Christy) Bryant, USN - Editor     |  |
|   |  |

## **EDITOR'S NOTE**

The production of the Annual Tropical Cyclone Report (ATCR) has always been a time and resource intensive project and, with 2003, the time has come for this to change. In a time of decreasing budgets and fewer personnel, the ATCR may have become a thing of the past. In an effort to continue to provide this information to the customers and researchers that use it, several changes have been made that reflect changing technology while meeting the needs of the user. This is the first step towards a more streamlined ATCR that can be updated quickly and reach the user sooner.

First, the format is new and different. Our previous format was based on the premise that a final product would be a printed version. Since our users primarily use electronic format, we have taken a major step towards a primarily electronic finished product. Depending on the feedback we receive from those who use this year's document, this format may change even further.

Expanding menus indicated by plus (+) and minus (-) signs in the frame on the left side of the screen should make navigation of the ATCR easier for most users. Simply click any (+) sign to open a menu another level.

Updates to the ATCR will be relatively frequent and occur whenever a storm review is complete or when new data is made available. To communicate updates, there is a banner on the cover page that will indicate the latest update and the date of the update.

All the chapters that our users have become familiar with still exist, with the exception of Chapter 6: Research, however they have been re-organized and combined. Instead of a Chapter 5: TC Verification, the verification information for each storm has been included on an expanded storm summary page.

We understand that there is still a need to print the ATCR, but less frequently the entire book. More often, a single storm is needed or a specific selection of data. To maximize the ease with which this is done, print friendly icons will exist on every storm page that will open a .pdf file of that page, ready for print. You can download Adobe Acrobat Reader, free of charge, from the Adobe website.

By starting over, from the ground up, JTWC hopes to provide our users with what they need in a timely manner and in a format that is convenient for the largest percentage of users. During the coding for this, I deliberately left the html code unconcealed in any way. If you like any part of it, please feel free to adapt the basic html code for your own purposes. Feedback is much appreciated and significant feedback may help shape this product in future years. You can

email me, the editor, using this link. EditorATCR

Special thanks for this ATCR go to Captain S. Vilpors, who passed on much guidance on what was really needed and provided statistics, TSgt R. Jacobs, who provided most of the graphics used for the storms, and AG2 L. Kelsey, who created best track images for every storm.

LT A. C. Bryant, USN

Editor, 2003 ATCR



#### **COVER**

**EDITOR'S NOTE** 

1. WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES



1.1 WESTERN NORTH PACIFIC OCEAN
TROPICAL CYCLONES

1.2 NORTH INDIAN OCEAN TROPICAL

**CYCLONES** 

1.3 SUMMARY OF WESTERN NORTH

PACIFIC AND NORTH INDIAN OCEAN

TROPICAL CYCLONES



TS 01W Yanyan

TY 02W Kujira

**TD 03W** 

TY 04W Chan-Hom

TS 05W Linfa

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TY 08W Koni

STY 09W Imbudo

TY 10W Morakot

TY 11W Etau

TY 12W Krovanh

TS 13W Vamco

TY 14W Dujuan

| TY 16W Choi-Wan  |                |
|--|----------------|
|  |                |
| TY 17W Koppu   |                |
| <u>TD 18W</u>  |                |
| <u>TD 19W</u>  |                |
| TY 20W Ketsana   |                |
| TY 21W Parma   |                |
| <u>TD 22W</u>  |                |
| <u>TS 23W</u>  |                |
| TY 24W Melor   |                |
| TY 25W Nepartak  |                |
| STY 26W Lupit  |                |
| <u>TS 27W</u>  |                |
| <u>TC 01B</u>  |                |
| <u>TC 02A</u>  |                |
| <u>TC 03B</u>  |                |
| 2. SOUTH PACIFIC AND SOUTH INDIAN  |                |
| OCEAN TROPICAL CYCLONES  |                |
|  | $\blacksquare$ |
| 2.1 GENERAL  |                |
| 2.2 SUMMARY  |                |
|  |                |
| 12.3 SUMMARY OF SOUTH PACIFIC AND  |                |
| 2.3 SUMMARY OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL   |                |
| SOUTH INDIAN OCEAN TROPICAL  |                |
|  | <b>(</b>       |
| SOUTH INDIAN OCEAN TROPICAL  | #              |
| SOUTH INDIAN OCEAN TROPICAL  CYCLONES  | #              |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S   | <b></b>        |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang  | <b></b>        |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang TC 03S Boura   | #              |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande                                  | #              |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 05S Crystal                   | #              |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 05S Crystal TC 06P Zoe        | #              |
| SOUTH INDIAN OCEAN TROPICAL CYCLONES  TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 05S Crystal TC 06P Zoe TC 07S | +              |
| TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 05S Crystal TC 06P Zoe TC 07S TC 08S Delfina                        | #              |
| TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 05S Crystal TC 06P Zoe TC 07S TC 08S Delfina TC 09S Ebula           | #              |
| TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 06P Zoe TC 07S TC 08S Delfina TC 09S Ebula TC 10P Ami TC 11S Fari   | <b>±</b>       |
| TC 01S TC 02S Atang TC 03S Boura TC 04P Yolande TC 06P Zoe TC 07S TC 08S Delfina TC 09S Ebula TC 10P Ami               | #              |

| 2003 ATCK Navigation   |                |
|--|----------------|
| TC 14S Fiona   |                |
| TC 15P Dovi  |                |
| TC 16S Gerry   |                |
| TC 17S Hape  |                |
| TC 18S Isha  |                |
| TC 19S Japhet  |                |
| TC 20S Graham  |                |
| TC 21S Harriet   |                |
| TC 22P Erica   |                |
| TC 23S Kalunde   |                |
| TC 24S Craig   |                |
| TC 25P Eseta   |                |
| TC 26S Inigo   |                |
| TC 27P Fili  |                |
| TC 28S Manou   |                |
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| 3. TROPICAL CYCLONE FIX DATA   |                |
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| <u>VERIFICATION</u>  |                |
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| 4.1 ANNUAL FORECAST VERIFICATION   |                |
| 4.2 TESTING AND RESULTS  |                |
| <u>January and American State of the Control of the C</u> |                |

## 1. SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

#### 1.1 WESTERN NORTH PACIFIC OCEAN TROPICAL CYCLONES

# All Information for Northwestern Pacific Not Yet Complete

Tropical cyclone genesis regions compared to the 15-year average are shown in Figure 1-1. This year's tropical cyclones are listed in Table 1-1. Table 1-2 shows the monthly distribution of tropical cyclones for each year since 1959 and Table 1-3 shows the monthly average occurrence of tropical storms separated into: (1) typhoons only; and (2) tropical storms and typhoons. A summary of this year's Tropical Cyclone Formation Alerts is shown in Table 1-4. The annual number of tropical cyclones of tropical storm strength and higher appear in Figure 1-2, while the number of super typhoons are shown in Figure 1-3. Figure 1-4 represents a composite of the 45 year average for tropical cyclones. Composites of the tropical cyclone best tracks for the western North Pacific appear following Figure 1-4.

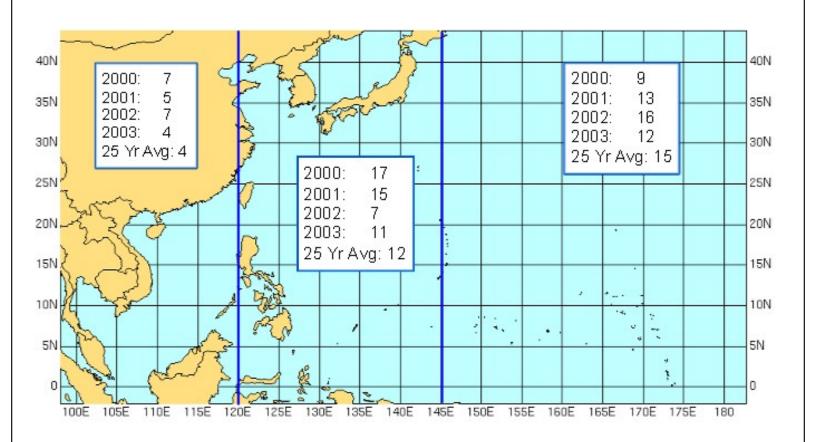


Figure 1-1. Comparison of the number of tropical cyclones that developed within 3 designated areas for 2000 through 2003 and the 15-year average.

| NAME *   | ACIFIC SIGNIFICANT (01 JAN 2003 - 31 PERIOD  |  | EST MAX SFC<br>WINDS<br>KTS (M/SEC)  | MSLP<br>(MB)**  |
|----------|--|--|--|---|
|          |  | WARNINGS   | WINDS  |   |
|          |  | WARNINGS   | WINDS  |   |
|          | PERIOD   |  | WINDS  |   |
|          |  |  |  | (IVID)  |
|          |  |  |  |   |
| ⁄anYan   | 15JAN-21JAN  | 22   | 50 (25)  | 987   |
| Kujira   | 09APR-22APR  | 66   | 135 (68)   | 904   |
|          | 17MAY-20MAY  | 11   | 30 (15)  | 1000  |
| Chan-hom | 19MAY-27MAY  | 33   | 115 (58)   | 927   |
| ₋infa    | 25MAY-30MAY  | 24   | 60 (30)  | 980   |
| Nangka   | 31MAY-03JUN  | 11   | 50 (25)  | 987   |
| Soudelor | 11JUN-18JUN  | 33   | 115 (58)   | 927   |
| Koni     | 15JUL-22JUL  | 30   | 65 (33)  | 976   |
| mbudo    | 16JUL-24JUL  | 32   | 130 (65)   | 910   |
| Morakot  | 01AUG-05AUG  | 15   | 65 (33)  | 976   |
| tau      | 02AUG-09AUG  | 28   | 110 (55)   | 933   |
| Krovanh  | 15AUG-26AUG  | 40   | 90 (45)  | 954   |
| /amco    | 19AUG-20AUG  | 7  | 35 (18)  | 997   |
| Dujuan   | 28AUG-03SEP  | 24   | 125 (63)   | 916   |
| Maemi    | 05SEP-13SEP  | 31   | 150 (75)   | 885   |
| Choi-Wan | 17SEP-22SEP  | 21   | 95 (48)  | 949   |
| Корри    | 24SEP-30SEP  | 24   | 90 (45)  | 954   |
|          | 06OCT-10OCT  | 15   | 25 (13)  | 1002  |
|          | 120CT-130CT  | 5  | 30 (15)  | 1000  |
| Ketsana  | 18OCT-26OCT  | 30   | 125 (63)   | 916   |
| Parma    | 200CT-310CT  | 44   | 130 (65)   | 910   |
|          | 220CT-230CT  | 7  | 25 (13)  | 1002  |
|          | 23OCT-28OCT  | 14   | 35 (18)  | 997   |
| Melor    | 30OCT-04NOV  | 20   | 70 (35)  | 972   |
| Nepartak | 12NOV-19NOV  | 29   | 75 (38)  | 967   |
|          | Chan-hom infa langka Coudelor Coni mbudo Morakot ctau Crovanh Maemi Choi-Wan Coppu Cetsana Parma | Zujira         09APR-22APR           17MAY-20MAY           Chan-hom         19MAY-27MAY           Jinfa         25MAY-30MAY           Jangka         31MAY-03JUN           Joudelor         11JUN-18JUN           Joni         15JUL-22JUL           Morakot         01AUG-05AUG           Janco         01AUG-05AUG           Jorovanh         15AUG-26AUG           Janco         19AUG-20AUG           Joujuan         28AUG-03SEP           Johoi-Wan         17SEP-22SEP           Johoi-Wan         17SEP-22SEP           Joho-Van         12OCT-13OCT           Janco         18OCT-26OCT           Joho-Van         20OCT-31OCT           Joho-Van         22OCT-23OCT           Joho-Van         23OCT-28OCT           Joho-Van         30OCT-04NOV | Gujira       09APR-22APR       66         17MAY-20MAY       11         Chan-hom       19MAY-27MAY       33         Infa       25MAY-30MAY       24         Jangka       31MAY-03JUN       11         Joudelor       11JUN-18JUN       33         Joni       15JUL-22JUL       30         Morakot       01AUG-05AUG       15         Jorakot       01AUG-05AUG       15         Joramco       15AUG-26AUG       40         Jamco       19AUG-20AUG       7         Joujuan       28AUG-03SEP       24         Joeni-Wan       17SEP-22SEP       21         Joppu       24SEP-30SEP       24         Joppu       24SEP-30SEP       24         Joppu       24SEP-30CT       15         Jactori-13OCT       5         Jactori-24OCT       30         Jactori-25OCT       7         23OCT-28OCT       7         Jactori-26OCT       14         Jactori-26OCT       14         Jactori-28OCT       14         Jactori-28OCT       14 | Aujira       09APR-22APR       66       135 (68)         17MAY-20MAY       11       30 (15)         Chan-hom       19MAY-27MAY       33       115 (58)         Infa       25MAY-30MAY       24       60 (30)         Iangka       31MAY-03JUN       11       50 (25)         Boudelor       11JUN-18JUN       33       115 (58)         Boudelor       15JUL-22JUL       30       65 (33)         Brould       16JUL-24JUL       32       130 (65)         Brould       15       65 (33)       130 (65)         Brould       15       65 (33)       110 (55)         Brould       15       65 (33)       125 (63)         Brould       15AUG-26AUG       7       35 (18)         Brould       15AUG-26AUG       7 |

| STY 26W | Lupit | 20NOV-01DEC | 47  | 145 (73) | 891 |
|---------|-------|-------------|-----|----------|-----|
| TS 27W  |       | 24DEC-27DEC | 15  | 35 (18)  | 997 |
|         |       |             |     |          |     |
|         |       |             |     |          |     |
|         |       | TOTAL #     | 678 |          |     |

<sup>\*</sup> As Designated by WMO authorized RSMC

#### Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2003 **YEAR** JAN **FEB** MAR APR MAY JUN JUL AUG SEP OCT NOV DEC TOTALS 0 0 1 3 1 3 20 11 11 3 1 3 3 1 1 0 0 1 3 1 0 3 1 1 3 3 1 26 13 5 3 1 0 21 13 6

<sup>\*\*</sup> MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

|      | 0 0 0 | 000   | 0 0 0 | 100   | 200   | 100   | 3 1 0 | 5 3 1 | 5 3 2 | 112   | 122   | 101   | 20 10 8 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| 1967 | 1     | 0     | 2     | 1     | 1     | 1     | 8     | 10    | 8     | 4     | 4     | 1     | 41      |
|      | 0 1 0 | 000   | 110   | 100   | 0 1 0 | 100   | 3 3 2 | 3 4 3 | 5 3 0 | 211   | 400   | 0 1 0 | 20 15 6 |
| 1968 | 0     | 1     | 0     | 1     | 0     | 4     | 3     | 8     | 4     | 6     | 4     | 0     | 31      |
|      | 0 0 0 | 0 0 1 | 0 0 0 | 100   | 000   | 202   | 120   | 3 4 1 | 400   | 5 1 0 | 400   | 0 0 0 | 20 7 4  |
| 1969 | 1     | 0     | 1     | 1     | 0     | 0     | 3     | 3     | 6     | 5     | 2     | 1     | 23      |
|      | 100   | 0 0 0 | 0 1 0 | 100   | 0 0 0 | 0 0 0 | 210   | 210   | 204   | 4 1 0 | 1 1 0 | 0 1 0 | 13 6 4  |
| 1970 | 0     | 1     | 0     | 0     | 0     | 2     | 3     | 7     | 4     | 6     | 4     | 0     | 27      |
|      | 0 0 0 | 100   | 0 0 0 | 0 0 0 | 0 0 0 | 110   | 0 2 1 | 421   | 220   | 3 2 1 | 1 3 0 | 0 0 0 | 12 12 3 |
| 1971 | 1     | 0     | 1     | 2     | 5     | 2     | 8     | 5     | 7     | 4     | 2     | 0     | 37      |
|      | 0 1 0 | 0 0 0 | 0 1 0 | 200   | 230   | 200   | 620   | 3 1 1 | 5 1 1 | 3 1 0 | 1 1 0 | 0 0 0 | 24 11 2 |
| 1972 | 1     | 0     | 1     | 0     | 0     | 4     | 5     | 5     | 6     | 5     | 2     | 3     | 32      |
|      | 100   | 000   | 0 0 1 | 000   | 0 0 0 | 220   | 4 1 0 | 3 2 0 | 411   | 4 1 0 | 200   | 210   | 22 8 2  |
| 1973 | 0     | 0     | 0     | 0     | 0     | 0     | 7     | 6     | 3     | 4     | 3     | 0     | 23      |
|      | 0 0 0 | 000   | 0 0 0 | 000   | 0 0 0 | 0 0 0 | 4 3 0 | 2 3 1 | 2 0 1 | 4 0 0 | 030   | 0 0 0 | 12 9 2  |
| 1974 | 1     | 0     | 1     | 1     | 1     | 4     | 5     | 7     | 5     | 4     | 4     | 2     | 35      |
|      | 0 1 0 | 0 0 0 | 0 1 0 | 010   | 100   | 1 2 1 | 230   | 232   | 3 2 0 | 4 0 0 | 220   | 020   | 15 17 3 |
| 1975 | 1     | 0     | 0     | 1     | 0     | 0     | 1     | 6     | 5     | 6     | 3     | 2     | 25      |
|      | 100   | 0 0 0 | 0 0 0 | 0 0 1 | 0 0 0 | 0 0 0 | 0 1 0 | 4 1 1 | 410   | 3 2 1 | 210   | 020   | 14 6 5  |
| 1976 | 1     | 1     | 0     | 2     | 2     | 2     | 4     | 4     | 5     | 0     | 2     | 2     | 25      |
|      | 100   | 0 1 0 | 0 0 0 | 110   | 200   | 200   | 220   | 1 3 0 | 410   | 0 0 0 | 110   | 020   | 14 11 0 |
| 1977 | 0     | 0     | 1     | 0     | 1     | 1     | 4     | 2     | 5     | 4     | 2     | 1     | 21      |
|      | 0 0 0 | 0 0 0 | 010   | 000   | 0 0 1 | 0 1 0 | 3 0 1 | 020   | 230   | 3 1 0 | 200   | 100   | 11 8 2  |
| 1978 | 1     | 0     | 0     | 1     | 0     | 3     | 4     | 8     | 4     | 7     | 4     | 0     | 32      |
|      | 0 1 0 | 0 0 0 | 000   | 100   | 000   | 030   | 3 1 0 | 3 4 1 | 3 1 0 | 412   | 121   | 000   | 15 13 4 |
| 1979 | 1     | 0     | 1     | 1     | 2     | 0     | 5     | 4     | 6     | 3     | 2     | 3     | 28      |
|      | 100   | 000   | 100   | 100   | 0 1 1 | 0 0 0 | 221   | 202   | 3 3 0 | 210   | 110   | 111   | 14 9 5  |
| 1980 | 0     | 0     | 1     | 1     | 4     | 1     | 5     | 3     | 7     | 4     | 1     | 1     | 28      |
|      | 000   | 0 0 0 | 0 0 1 | 010   | 220   | 0 1 0 | 3 1 1 | 201   | 5 1 1 | 220   | 100   | 010   | 15 9 4  |
| 1981 | 0     | 0     | 1     | 1     | 1     | 2     | 5     | 8     | 4     | 2     | 3     | 2     | 29      |
|      | 000   | 000   | 100   | 010   | 0 1 0 | 200   | 230   | 251   | 400   | 110   | 210   | 200   | 16 12 1 |
| 1982 | 0     | 0     | 3     | 0     | 1     | 3     | 4     | 5     | 6     | 4     | 1     | 1     | 28      |
|      | 0 0 0 | 000   | 210   | 000   | 100   | 120   | 220   | 500   | 3 2 1 | 3 0 1 | 100   | 100   | 1972    |
| 1983 | 0     | 0     | 0     | 0     | 0     | 1     | 3     | 6     | 3     | 5     | 5     | 2     | 25      |
|      | 000   | 000   | 000   | 000   | 000   | 010   | 300   | 2 3 1 | 111   | 320   | 320   | 020   | 12 11 2 |
| 1984 | 0     | 0     | 0     | 0     | 0     | 2     | 5     | 7     | 4     | 8     | 3     | 1     | 30      |
|      | 0 0 0 | 000   | 000   | 000   | 0 0 0 | 020   | 410   | 232   | 1 3 0 | 5 2 1 | 300   | 100   | 16 11 3 |
| 1985 | 2     | 0     | 0     | 0     | 1     | 3     | 1     | 7     | 5     | 5     | 1     | 2     | 27      |
|      | 020   | 000   | 000   | 000   | 100   | 201   | 100   | 520   | 320   | 410   | 010   | 110   | 17 9 1  |

| 1986    | 0     | 1     | 0     | 1     | 2     | 2     | 2     | 5     | 2     | 5     | 4     | 3   | 27       |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|----------|
|         | 000   | 100   | 000   | 100   | 110   | 110   | 200   | 410   | 200   | 320   | 220   | 210 | 1980     |
| 1987    | 1     | 0     | 0     | 1     | 0     | 2     | 4     | 4     | 7     | 2     | 3     | 1   | 25       |
|         | 100   | 000   | 000   | 010   | 000   | 110   | 400   | 3 1 0 | 5 1 1 | 200   | 120   | 100 | 18 6 1   |
| 1988    | 1     | 0     | 0     | 0     | 1     | 3     | 2     | 5     | 8     | 4     | 2     | 1   | 27       |
|         | 100   | 000   | 000   | 000   | 100   | 111   | 110   | 230   | 260   | 400   | 200   | 010 | 14 12 1  |
| 1989    | 1     | 0     | 0     | 1     | 2     | 2     | 6     | 8     | 4     | 6     | 3     | 2   | 35       |
|         | 010   | 000   | 000   | 100   | 200   | 110   | 231   | 3 3 2 | 220   | 600   | 300   | 101 | 21 10 4  |
| 1990    | 1     | 0     | 0     | 1     | 2     | 4     | 4     | 5     | 5     | 5     | 4     | 1   | 32       |
|         | 100   | 000   | 000   | 010   | 110   | 211   | 220   | 500   | 410   | 230   | 3 1 0 | 100 | 21 10 1  |
| 1991    | 0     | 0     | 2     | 1     | 1     | 1     | 4     | 8     | 6     | 3     | 6     | 0   | 32       |
|         | 0 0 0 | 000   | 110   | 010   | 100   | 100   | 400   | 3 3 2 | 420   | 300   | 3 3 0 | 000 | 20 10 2  |
| 1992    | 1     | 1     | 0     | 0     | 0     | 3     | 4     | 8     | 5     | 6     | 5     | 0   | 33       |
|         | 100   | 010   | 000   | 000   | 000   | 210   | 220   | 4 4 0 | 410   | 5 1 0 | 3 1 1 | 000 | 21 11 1  |
| 1993    | 0     | 0     | 2     | 2     | 1     | 2     | 5     | 8     | 5     | 6     | 4     | 3   | 38       |
|         | 0 0 0 | 000   | 0 1 1 | 002   | 0 1 0 | 101   | 320   | 611   | 410   | 3 2 1 | 112   | 300 | 21 9 8   |
| 1994    | 1     | 0     | 1     | 0     | 2     | 2     | 9     | 9     | 8     | 7     | 0     | 2   | 41       |
|         | 0 0 1 | 0 0 0 | 100   | 000   | 101   | 020   | 3 4 2 | 630   | 4 4 0 | 5 1 1 | 000   | 110 | 21 15 5  |
| 1995    | 1     | 0     | 0     | 0     | 1     | 2     | 3     | 7     | 7     | 8     | 2     | 3   | 34       |
|         | 0 0 1 | 0 0 0 | 0 0 0 | 0 0 0 | 0 1 0 | 020   | 210   | 421   | 412   | 5 1 2 | 020   | 012 | 15 11 8  |
| 1996    | 1     | 1     | 0     | 2     | 2     | 0     | 7     | 10    | 7     | 5     | 6     | 3   | 43       |
|         | 0 0 1 | 0 0 1 | 000   | 0 1 1 | 110   | 0 0 0 | 610   | 4 3 3 | 610   | 212   | 132   | 111 | 21 12 10 |
| 1997    | 1     | 0     | 0     | 2     | 3     | 3     | 4     | 8     | 4     | 6     | 1     | 1   | 33       |
|         | 0 1 0 | 000   | 000   | 110   | 120   | 3 0 0 | 3 1 0 | 611   | 3 1 0 | 411   | 100   | 100 | 23 8 2   |
| 1998    | 0     | 0     | 0     | 0     | 0     | 0     | 3     | 3     | 8     | 6     | 3     | 4   | 27       |
|         | 0 0 0 | 000   | 000   | 000   | 000   | 000   | 012   | 210   | 413   | 213   | 030   | 112 | 9 8 10   |
| 1999    | 1     | 1     | 0     | 3     | 0     | 1     | 5     | 9     | 6     | 2     | 3     | 3   | 34       |
|         | 010   | 0 1 0 | 000   | 210   | 000   | 100   | 113   | 423   | 240   | 110   | 111   | 003 | 12 12 10 |
| 2000    | 0     | 0     | 0     | 0     | 4     | 0     | 8     | 9     | 6     | 3     | 3     | 1   | 34       |
|         | 0 0 0 | 000   | 000   | 000   | 112   | 000   | 233   | 432   | 411   | 210   | 111   | 100 | 15 10 9  |
| 2001    | 0     | 1     | 0     | 1     | 1     | 2     | 6     | 7     | 5     | 3     | 3     | 4   | 33       |
|         | 0 0 0 | 0 0 1 | 000   | 0 0 1 | 010   | 200   | 411   | 3 3 1 | 500   | 300   | 120   | 220 | 20 9 4   |
| 2002    | 1     | 1     | 1     | 1     | 2     | 3     | 6     | 8     | 3     | 5     | 1     | 1   | 33       |
|         | 0 1 0 | 100   | 0 0 1 | 0 0 1 | 101   | 300   | 3 2 1 | 4 3 1 | 120   | 302   | 100   | 100 | 18 8 7   |
| 2003    | 1     | 0     | 0     | 1     | 3     | 2     | 2     | 5     | 3     | 6     | 3     | 1   | 27       |
|         | 0 1 0 | 000   | 000   | 100   | 111   | 110   | 200   | 410   | 3 0 0 | 213   | 300   | 010 | 17 6 4   |
|         |       |       |       |       |       |       |       |       |       |       |       |     |          |
| (1959-2 | 2003) |       |       |       |       |       |       |       |       |       |       |     |          |

| MEAN  | 0.6 | 0.3 | 0.5 | 0.8 | 1.3 | 2.0 | 4.6 | 6.6 | 5.6 | 4.7 | 2.9 | 1.6 | 31.7 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CASES | 26  | 14  | 24  | 37  | 60  | 90  | 209 | 299 | 254 | 213 | 130 | 72  | 1427 |

The criteria used in TABLE 12 are as follows:

- 1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
- 2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
- 3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

|                           | Table 1-2 Legend:                  |  |
|---------------------------|------------------------------------|--|
| Total month/year          |                                    |  |
| GTE 64 knots<br>(Typhoon) | 35 to 63 knots<br>(Tropical Storm) | LTE 34 knots<br>(Tropical<br>Depression) |

|                      | TABLE 1-3 WESTERN NORTH PACIFIC TROPICAL CYCLONES |        |        |      |        |        |       |        |      |       |      |     |        |
|----------------------|---|--------|--------|------|--------|--------|-------|--------|------|-------|------|-----|--------|
|                      |   | ARLE   | 1-3 VI | ESIE | KN N   | OKIH   | PACII | -IC IR | OPIC | AL CY | CLON | IES |        |
|                      |   |        |        |      |        |        |       |        |      |       |      |     |        |
| TYPHOONS (1945-1959) |   |        |        |      |        |        |       |        |      |       |      |     |        |
|                      | JAN   | FEB    | MAR    | APR  | MAY    | JUN    | JUL   | AUG    | SEP  | OCT   | NOV  | DEC | TOTALS |
| MEAN                 | 0.3   | 0.1    | 0.3    | 0.4  | 0.7    | 1      | 2.9   | 3.1    | 3.3  | 2.4   | 2    | 0.9 | 16.4   |
| CASES                | 5   | 1      | 4      | 6    | 10     | 15     | 29    | 46     | 49   | 36    | 30   | 14  | 245    |
|                      |   |        |        |      |        |        |       |        |      |       |      |     |        |
| TYPHO                | ONS (1  | 960-20 | 03)    |      |        |        |       |        |      |       |      |     |        |
|                      | JAN   | FEB    | MAR    | APR  | MAY    | JUN    | JUL   | AUG    | SEP  | OCT   | NOV  | DEC | TOTALS |
| MEAN                 | 0.2   | 0.1    | 0.2    | 0.4  | 0.7    | 1.1    | 2.7   | 3.5    | 3.4  | 3.1   | 1.6  | 0.7 | 17.6   |
| CASES                | 10  | 3      | 8      | 19   | 30     | 48     | 119   | 153    | 148  | 137   | 70   | 31  | 776    |
|                      |   |        |        |      |        |        |       |        |      |       |      |     |        |
| TROPIC               | AL ST   | ORMS   | AND T  | YPHO | ONS (1 | 945-19 | 959)  |        |      |       |      |     |        |

|  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|
| MEAN                                     | 0.4 | 0.1 | 0.5 | 0.5 | 8.0 | 1.6 | 2.9 | 4   | 4.2 | 3.3 | 2.7 | 1.2 | 22.2   |
| CASES                                    | 6   | 2   | 7   | 8   | 11  | 22  | 44  | 60  | 64  | 49  | 41  | 18  | 332    |
|  |     |     |     |     |     |     |     |     |     |     |     |     |        |
| TROPICAL STORMS AND TYPHOONS (1960-2003) |     |     |     |     |     |     |     |     |     |     |     |     |        |
|  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |
| MEAN                                     | 0.5 | 0.2 | 0.4 | 0.7 | 1.1 | 1.8 | 4.1 | 5.6 | 5   | 4.1 | 2.6 | 1.3 | 27.5   |
| CASES                                    | 23  | 10  | 17  | 30  | 50  | 78  | 182 | 246 | 221 | 181 | 116 | 56  | 1210   |

|      |                  | TA                                    | ABLE 1-4                      |   |   |
|------|------------------|---------------------------------------|-------------------------------|---|---|
| TR   | OPICAL (         | CYCLONE F                             | ORMATION                      | ALERTS FOR                                    | RTHE  |
| W    | /ESTERN          | NORTH PAG                             | CIFIC OCEA                    | N FOR 1976-2                                  | 2003  |
| YEAR | INITIAL<br>TCFAS | TROPICAL<br>CYCLONES<br>WITH<br>TCFAS | TOTAL<br>TROPICAL<br>CYCLONES | PROBABILITY<br>OF TCFA<br>WITHOUT<br>WARNING* | PROBABILITY<br>OF TCFA<br>BEFORE<br>WARNING |
| 1976 | 34               | 25                                    | 25                            | 26%   | 100%  |
| 1977 | 26               | 20                                    | 21                            | 23%   | 95%   |
| 1978 | 32               | 27                                    | 32                            | 16%   | 84%   |
| 1979 | 27               | 23                                    | 28                            | 15%   | 82%   |
| 1980 | 37               | 28                                    | 28                            | 24%   | 100%  |
| 1981 | 29               | 28                                    | 29                            | 3%  | 96%   |
| 1982 | 36               | 26                                    | 28                            | 28%   | 93%   |
| 1983 | 31               | 25                                    | 25                            | 19%   | 100%  |
| 1984 | 37               | 30                                    | 30                            | 19%   | 100%  |
| 1985 | 39               | 26                                    | 27                            | 33%   | 96%   |
|      |                  |                                       |                               |   |   |

|                 | 38           | 27              | 27          | 29%    | 100%   |
|-----------------|--------------|-----------------|-------------|--------|--------|
| 1987            | 31           | 24              | 25          | 23%    | 96%    |
| 1988            | 33           | 26              | 27          | 21%    | 96%    |
| 1989            | 51           | 32              | 35          | 37%    | 91%    |
| 1990            | 33           | 30              | 31          | 9%     | 97%    |
| 1991            | 37           | 29              | 31          | 22%    | 94%    |
| 1992            | 36           | 32              | 32          | 11%    | 100%   |
| 1993            | 50           | 35              | 38          | 30%    | 92%    |
| 1994            | 50           | 40              | 40          | 20%    | 100%   |
| 1995            | 54           | 33              | 35          | 39%    | 94%    |
| 1996            | 41           | 39              | 43          | 5%     | 91%    |
| 1997            | 36           | 30              | 33          | 17%    | 91%    |
| 1998            | 38           | 18              | 27          | 53%    | 67%    |
| 1999            | 39           | 29              | 33          | 26%    | 88%    |
| 2000            | 40           | 31              | 34          | 23%    | 91%    |
| 2001            | 34           | 28              | 33          | 18%    | 82%    |
| 2002            | 39           | 31              | 33          | 21%    | 94%    |
| 2003            | 31           | 27              | 27          | 1%     | 100%   |
| (1976-<br>2003) |              |                 |             |        |        |
| MEAN:           | 37.1         | 28.5            | 30.6        | 21.82% | 93.21% |
| TOTALS:         | 1039         | 779             | 857         |        |        |
| * Percentage    | e of initial | ΓCFAs not follo | wed by warn | ings.  | 1      |

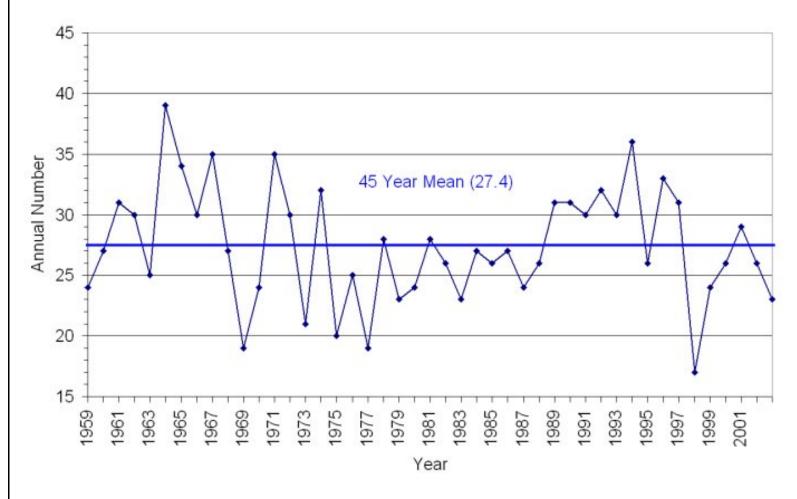


Figure 1-2. Tropical cyclones of tropical storm or greater intensity in the western North Pacific (1959-2003).

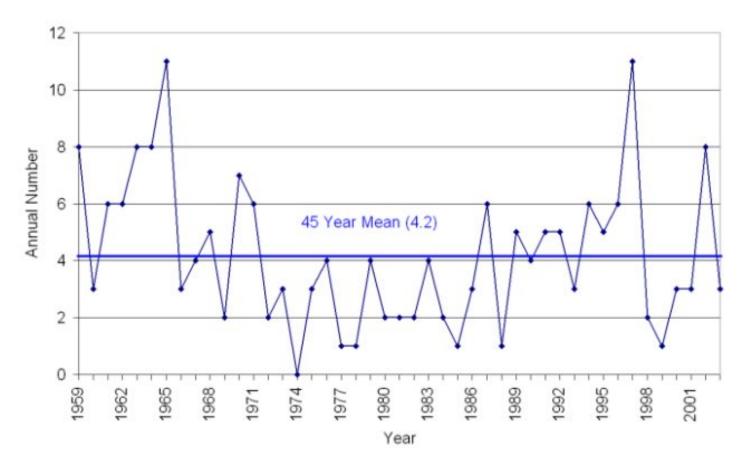


Figure 1-3. Number of western North Pacific super typhoons (1959-2003).

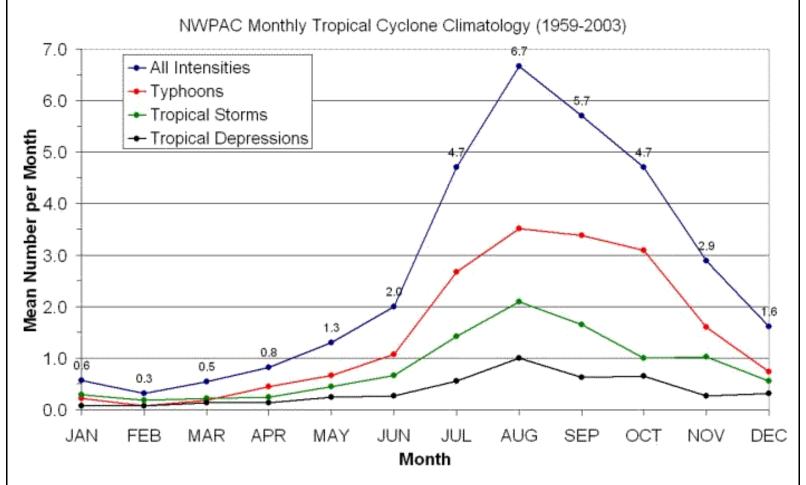
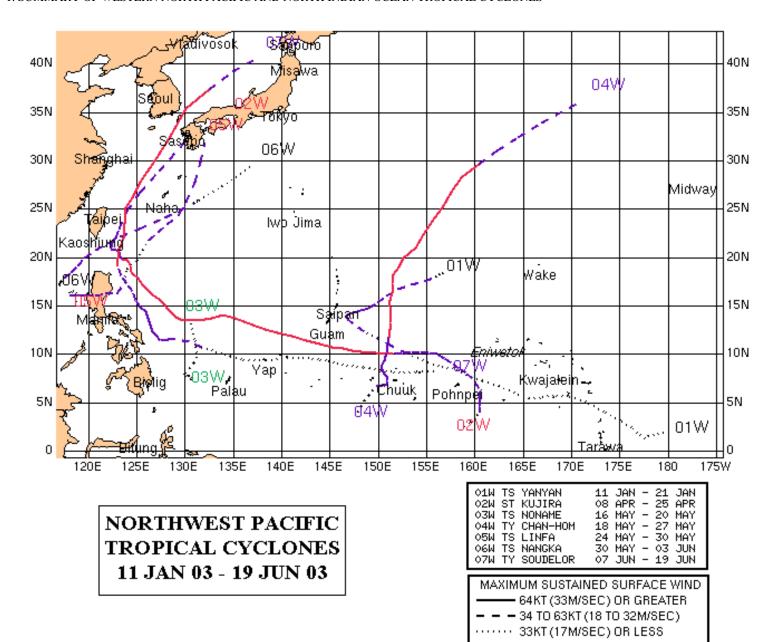
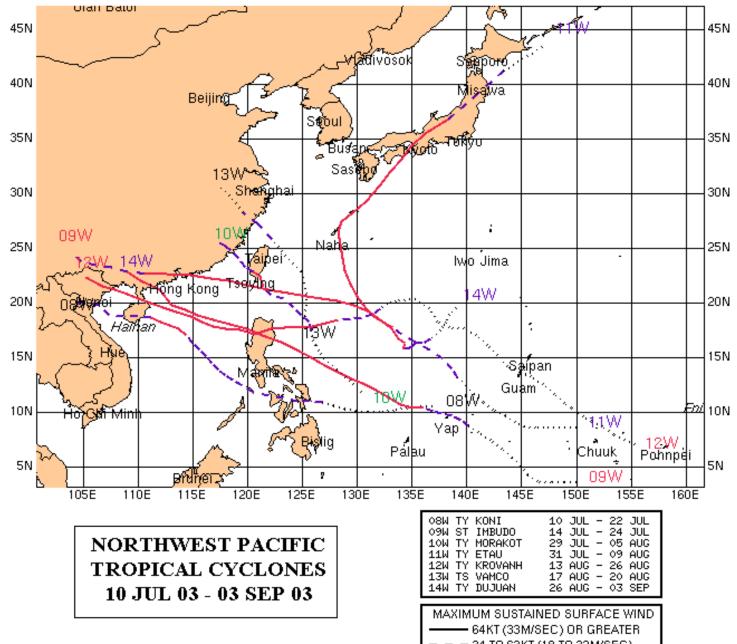
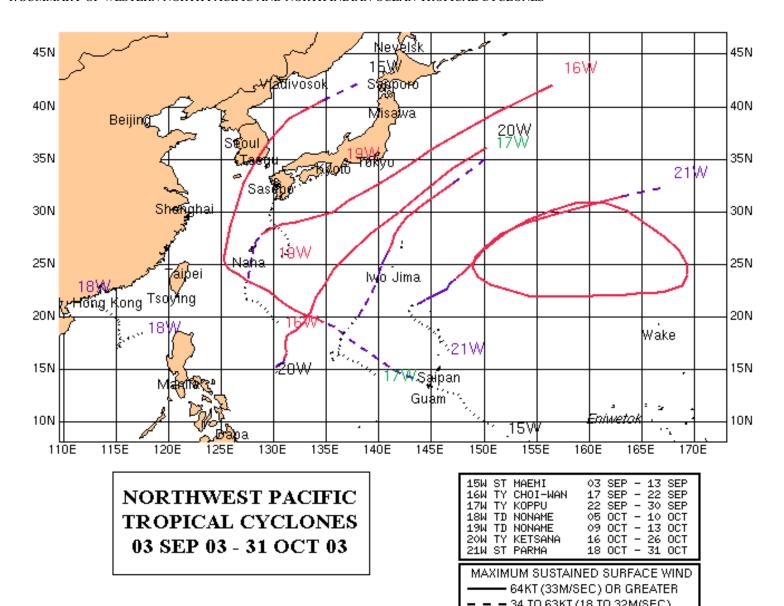


Figure 1-4. Average monthly tropical cyclones of all strengths (1959-2003).

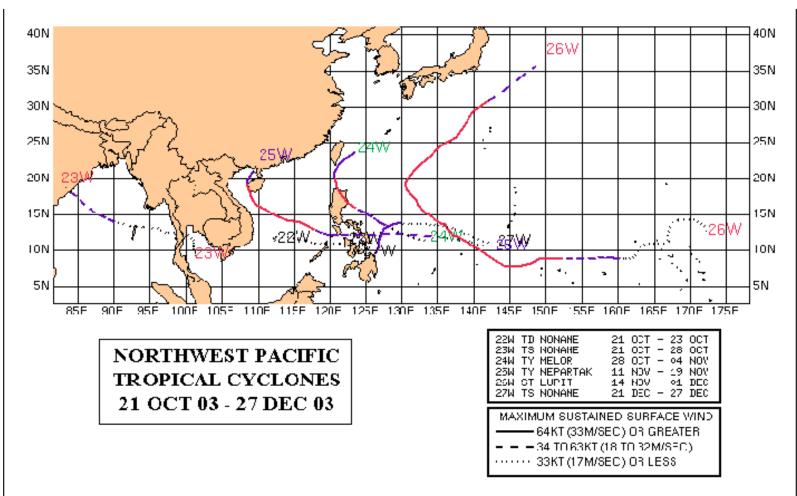




– 34 TO 63KT (18 TO 32M/SEC) ...... 33KT (17M/SEC) OR LESS



34 TO 63KT (18 TO 32M/SEC)
 33KT (17M/SEC) OR LESS



Go To: Chapter 1.2 North Indian Tropical Cyclones

#### 1.2 NORTH INDIAN OCEAN TROPICAL CYCLONES

Tropical cyclone genesis regions are compared to the overall 25-year average in Figure 1-4. This year's North Indian Ocean tropical cyclones are listed in Table 1-5. The monthly distribution of tropical cyclones for each year since 1975 is shown in Table 1-6. Composites of the tropical cyclone best tracks for the Northern Indian Ocean appear following Table 1-6.

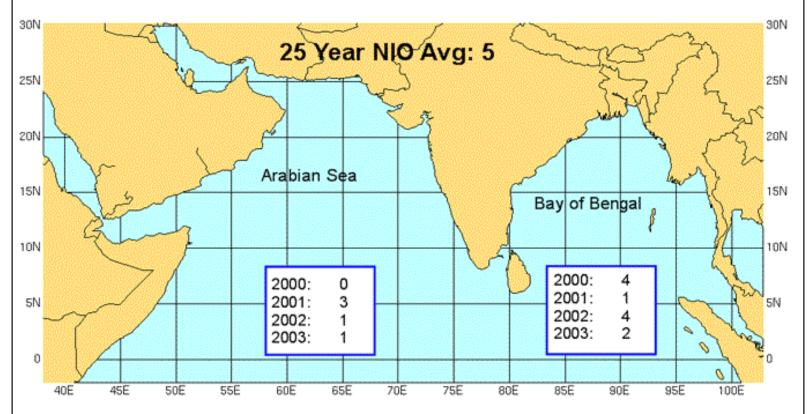


Figure 1-5. Comparison of the number of tropical cyclones that developed in Bay of Bengal and Arabian Sea for 2000 through 2003 and the 25-year average.

#### Table 1-5

## NORTH INDIAN OCEAN SIGNIFICANT TROPICAL CYCLONES FOR 2003

(01 JAN 2003 - 31 DEC 2003)

| тс  | NAME | PERIOD          | WARNINGS<br>ISSUED | EST MAX SFC<br>WINDS<br>KTS (M/SEC) | MSLP<br>(MB)* |
|-----|------|-----------------|--------------------|-------------------------------------|---------------|
| 01B | -    | 10 May - 19 May | 15                 | 65 (33)                             | 976           |
| 02A | -    | 12 Nov - 15 Nov | 11                 | 85 (44)                             | 958           |
| 03B | -    | 12 Dec - 15 Dec | 5                  | 55 (28)                             | 984           |
|     |      |                 |                    |                                     |               |
|     |      | JTWC Total      | 33                 |                                     |               |

\*MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

|      | Table 1-6   |       |       |       |      |       |      |      |      |      |       |       |       |  |  |
|------|---|-------|-------|-------|------|-------|------|------|------|------|-------|-------|-------|--|--|
| DI   | STRII   | BUTIC | ON OF | NOR   | THER | N INE | DIAN | OCEA | N TR | OPIC | AL CY | 'CLOI | NES   |  |  |
|      | FOR 1975 - 2003   |       |       |       |      |       |      |      |      |      |       |       |       |  |  |
| YEAR | AR JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC TOTALS |       |       |       |      |       |      |      |      |      |       |       |       |  |  |
|      |   | _     | _     |       | _    |       |      |      |      |      |       | _     | _     |  |  |
| 1975 | 1   | 0     | 0     | 0     | 2    | 0     | 0    | 0    | 0    | 1    | 2     | 0     | 6     |  |  |
|      | 0 1   | 0 0 0 | 000   | 0 0 0 | 200  | 0 0 0 | 0 0  | 000  | 000  | 100  | 020   | 0 0 0 | 3 3 0 |  |  |
| 1976 | 0   | 0     | 0     | 1     | 0    | 1     | 0    | 0    | 1    | 1    | 0     | 1     | 5     |  |  |
|      | 0 0   | 0 0 0 | 0 0 0 | 0 1 0 | 000  | 0 1 0 | 0 0  | 000  | 010  | 010  | 000   | 010   | 0 5 0 |  |  |
| 1977 | 0   | 0     | 0     | 0     | 1    | 1     | 0    | 0    | 0    | 1    | 0     | 2     | 5     |  |  |

|      | 0 0 | 000 | 000 | 0 0 0 | 010   | 0 1 0 | 0 0<br>0 | 000 | 000 | 010 | 0 0 0 | 1 1 0 | 1 4 0 |
|------|-----|-----|-----|-------|-------|-------|----------|-----|-----|-----|-------|-------|-------|
| 1978 | 0   | 0   | 0   | 0     | 1     | 0     | 0        | 0   | 0   | 1   | 2     | 0     | 4     |
|      | 0 0 | 000 | 000 | 000   | 0 1 0 | 0 0 0 | 0 0<br>0 | 000 | 000 | 010 | 200   | 0 0 0 | 220   |
| 1979 | 0   | 0   | 0   | 0     | 1     | 1     | 0        | 0   | 2   | 1   | 2     | 0     | 7     |
|      | 0 0 | 000 | 000 | 000   | 100   | 0 1 0 | 0 0<br>0 | 000 | 011 | 010 | 0 1 1 | 000   | 1 4 2 |
| 1980 | 0   | 0   | 0   | 0     | 0     | 0     | 0        | 0   | 0   | 0   | 1     | 1     | 2     |
|      | 0 0 | 000 | 000 | 000   | 000   | 000   | 0 0<br>0 | 000 | 000 | 000 | 010   | 010   | 020   |
| 1981 | 0   | 0   | 0   | 0     | 0     | 0     | 0        | 0   | 1   | 0   | 1     | 1     | 3     |
|      | 0 0 | 000 | 000 | 0 0 0 | 000   | 0 0 0 | 0 0<br>0 | 000 | 010 | 000 | 100   | 100   | 210   |
| 1982 | 0   | 0   | 0   | 0     | 1     | 1     | 0        | 0   | 0   | 2   | 1     | 0     | 5     |
|      | 0 0 | 000 | 000 | 000   | 100   | 010   | 0 0<br>0 | 000 | 000 | 020 | 100   | 000   | 230   |
| 1983 | 0   | 0   | 0   | 0     | 0     | 0     | 0        | 1   | 0   | 1   | 1     | 0     | 3     |
|      | 0 0 | 000 | 000 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0<br>0 | 010 | 000 | 010 | 010   | 0 0 0 | 030   |
| 1984 | 0   | 0   | 0   | 0     | 1     | 0     | 0        | 0   | 0   | 1   | 2     | 0     | 4     |
|      | 0 0 | 000 | 000 | 0 0 0 | 010   | 0 0 0 | 0 0<br>0 | 000 | 000 | 010 | 200   | 000   | 220   |
| 1985 | 0   | 0   | 0   | 0     | 2     | 0     | 0        | 0   | 0   | 2   | 1     | 1     | 6     |
|      | 0 0 | 000 | 000 | 0 0 0 | 020   | 000   | 0 0<br>0 | 000 | 000 | 020 | 010   | 010   | 060   |

| 1986 | 1        | 0     | 0   | 0     | 0   | 0     | 0        | 0     | 0     | 0   | 2     | 0   | 3     |
|------|----------|-------|-----|-------|-----|-------|----------|-------|-------|-----|-------|-----|-------|
| 1300 |          |       |     |       |     |       |          |       |       |     |       |     |       |
|      | 0 1      | 0 0 0 | 000 | 000   | 000 | 000   | 0 0      | 0 0 0 | 000   | 000 | 020   | 000 | 030   |
| 1987 | 0        | 1     | 0   | 0     | 0   | 2     | 0        | 0     | 0     | 2   | 1     | 2   | 8     |
|      | 0 0      | 010   | 000 | 000   | 000 | 020   | 0 0      | 000   | 000   | 020 | 010   | 020 | 080   |
| 1988 | 0        | 0     | 0   | 0     | 0   | 1     | 0        | 0     | 0     | 1   | 2     | 1   | 5     |
|      | 0 0      | 000   | 000 | 000   | 000 | 0 1 0 | 0 0      | 000   | 000   | 010 | 110   | 010 | 1 4 0 |
| 1989 | 0        | 0     | 0   | 0     | 1   | 1     | 0        | 0     | 0     | 0   | 1     | 0   | 3     |
|      | 0 0      | 000   | 000 | 000   | 010 | 010   | 0 0      | 000   | 000   | 000 | 100   | 000 | 120   |
| 1990 | 0        | 0     | 0   | 1     | 1   | 0     | 0        | 0     | 0     | 0   | 1     | 1   | 4     |
|      | 0 0      | 000   | 000 | 0 0 1 | 100 | 000   | 0 0      | 000   | 000   | 000 | 0 0 1 | 010 | 112   |
| 1991 | 1        | 0     | 0   | 1     | 0   | 1     | 0        | 0     | 0     | 0   | 1     | 0   | 4     |
|      | 0 1<br>0 | 000   | 000 | 100   | 000 | 010   | 0 0      | 000   | 000   | 000 | 100   | 000 | 220   |
| 1992 | 0        | 0     | 0   | 0     | 1   | 2     | 1        | 0     | 1     | 3   | 3     | 2   | 13    |
|      | 0 0      | 000   | 000 | 000   | 100 | 020   | 0 1<br>0 | 000   | 0 0 1 | 021 | 210   | 020 | 382   |
| 1993 | 0        | 0     | 0   | 0     | 0   | 0     | 0        | 0     | 0     | 0   | 2     | 0   | 2     |
|      | 0 0      | 000   | 000 | 0 0 0 | 000 | 000   | 0 0      | 000   | 000   | 000 | 200   | 000 | 200   |
| 1994 | 0        | 0     | 1   | 1     | 0   | 1     | 0        | 0     | 0     | 1   | 1     | 0   | 5     |
|      | J        | I     | J   | J     | J   | J     | J        | I     | J     | J   | I     | I   | 1     |

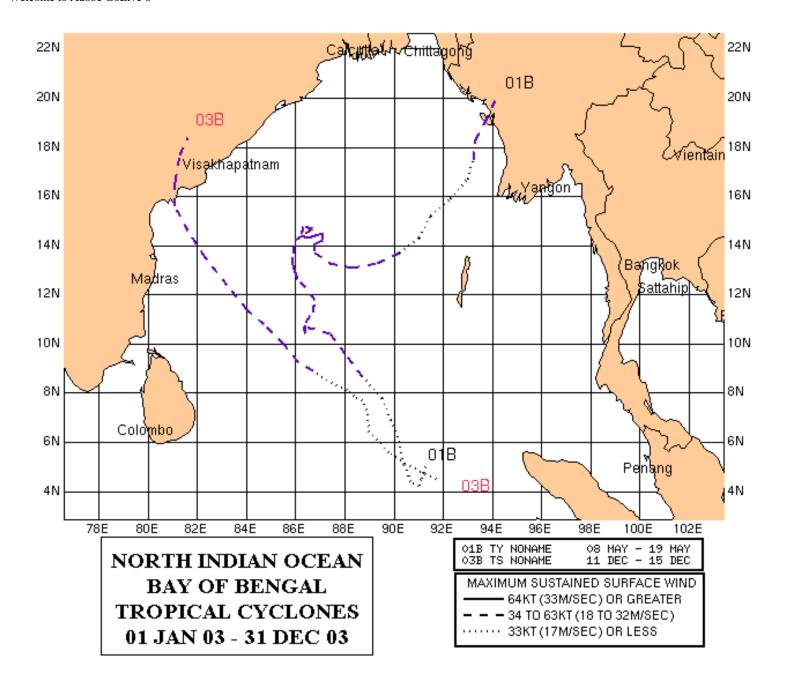
|      | 0 0 | 0 0 0 | 010   | 100   | 000   | 0 1 0 | 0 0 | 0 0 0 | 000   | 010   | 010   | 0 0 0 | 1 4 0 |
|------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|
| 1995 | 0   | 0     | 0     | 0     | 0     | 0     | 0   | 0     | 1     | 1     | 2     | 0     | 4     |
|      | 0 0 | 0 0 0 | 0 0 0 | 000   | 0 0 0 | 000   | 0 0 | 0 0 0 | 0 1 0 | 010   | 200   | 0 0 0 | 220   |
| 1996 | 0   | 0     | 0     | 0     | 1     | 3     | 0   | 0     | 0     | 2     | 2     | 0     | 8     |
|      | 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 1 0 | 120   | 0 0 | 0 0 0 | 000   | 1 1 0 | 200   | 0 0 0 | 4 4 0 |
| 1997 | 0   | 0     | 0     | 0     | 1     | 0     | 0   | 0     | 1     | 1     | 1     | 0     | 4     |
|      | 0 0 | 000   | 000   | 000   | 100   | 000   | 0 0 | 000   | 100   | 010   | 010   | 000   | 220   |
| 1998 | 0   | 0     | 0     | 0     | 2     | 1     | 0   | 0     | 1     | 1     | 2     | 1     | 8     |
|      | 0 0 | 000   | 000   | 000   | 110   | 100   | 0 0 | 000   | 010   | 010   | 200   | 100   | 5 3 0 |
| 1999 | 0   | 1     | 0     | 0     | 1     | 1     | 0   | 0     | 0     | 2     | 0     | 0     | 5     |
|      | 0 0 | 010   | 000   | 000   | 100   | 010   | 0 0 | 000   | 000   | 200   | 000   | 000   | 3 2 0 |
| 2000 | 0   | 0     | 0     | 0     | 0     | 0     | 0   | 0     | 0     | 2     | 1     | 1     | 4     |
|      | 0 0 | 000   | 000   | 000   | 000   | 000   | 0 0 | 000   | 000   | 020   | 100   | 010   | 130   |
| 2001 | 0   | 0     | 0     | 0     | 1     | 0     | 0   | 0     | 1     | 1     | 1     | 0     | 4     |
|      | 0 0 | 000   | 000   | 000   | 100   | 000   | 0 0 | 000   | 010   | 010   | 0 0 1 | 000   | 121   |
| 2002 | 0   | 0     | 0     | 0     | 2     | 0     | 0   | 0     | 0     | 0     | 2     | 1     | 5     |
|      | 0 0 | 0 0 0 | 000   | 000   | 020   | 0 0 0 | 0 0 | 0 0 0 | 000   | 0 0 0 | 020   | 010   | 0 5 0 |

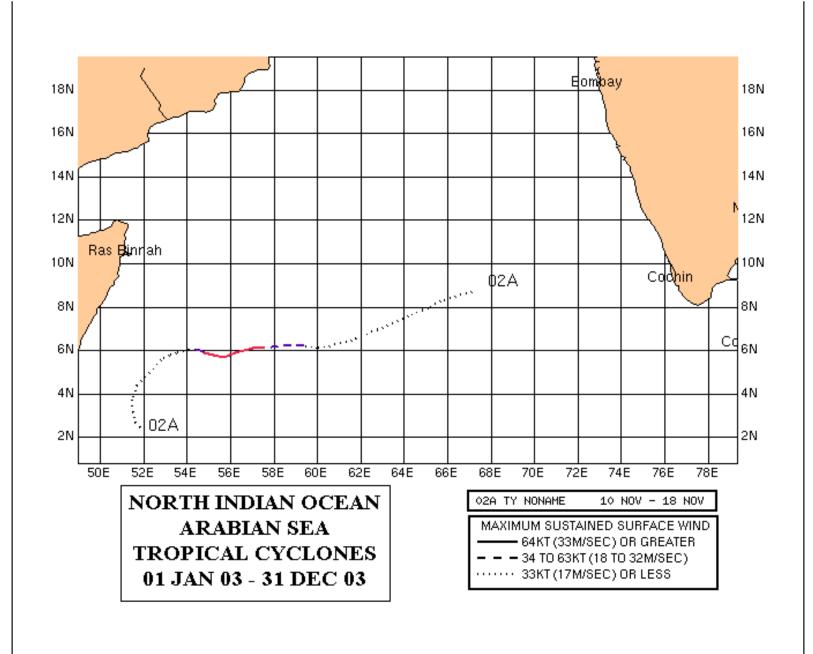
| 2003        | 0        | 0     | 0   | 0   | 1   | 0     | 0        | 0   | 0     | 0   | 1   | 1   | 3     |  |
|-------------|----------|-------|-----|-----|-----|-------|----------|-----|-------|-----|-----|-----|-------|--|
|             | 0 0<br>0 | 0 0 0 | 000 | 000 | 100 | 0 0 0 | 0 0<br>0 | 000 | 0 0 0 | 000 | 100 | 010 | 2 1 0 |  |
|             |          |       |     |     |     |       |          |     |       |     |     |     |       |  |
| (1975-2003) |          |       |     |     |     |       |          |     |       |     |     |     |       |  |
| MEAN        | 0.1      | 0.1   | 0   | 0.1 | 0.7 | 0.6   | 0        | 0   | 0.3   | 1   | 1.3 | 0.6 | 5     |  |
| CASES       | 3        | 2     | 1   | 4   | 21  | 17    | 1        | 1   | 9     | 28  | 39  | 16  | 142   |  |

The criteria used in TABLE 1-6 are as follows:

- 1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
- 2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
- 3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

|                           | Table 1-6 Legend:                  |  |
|---------------------------|------------------------------------|--|
| Total month/year          |                                    |  |
| GTE 64 knots<br>(Typhoon) | 35 to 63 knots<br>(Tropical Storm) | LTE 34 knots<br>(Tropical<br>Depression) |





#### **Tropical Storm (TS) 01W (Yan-Yan)**



First Poor : 0600Z 11 Jan 03 First Fair : 2330Z 12 Jan 03 First TCFA : 1600Z Jan 03

First Warning: 1800Z 15 Jan 03 Last Warning: 0000Z Jan 03

Max Intensity: 50 kts, gusts to 65 kts

Landfall: None

Total Warnings: 22

Remarks:

1) The first Northwest Pacific Ocean significant tropical cyclone of 2003, Tropical Storm (TS) 01W, developed in the near-equatorial trough east of Tarawa Island. After an initial westward track at 5 to 7 knots, the cyclone accelerated northwestwards towards Guam at speeds of 15 to 21 knots and slowly intensified. The first warning was issued on 15 January at 1800Z when the cyclone was located approximately 150 nm east of Pohnpei Island.

For approximately 72 hours after the initial warning, the cyclone continued on a west-northwestward course, with a track speed between 13 and 18 knots. Around 000Z on 18 January, 01W slowed in track as a mid-latitude cyclone over Japan weakened the subtropical ridge allowing the cyclone to sharply recurve to the northeast and attain a maximum intensity of 50 knots.

Around 0000Z on 20 January, satellite data indicated that the low level circulation center was becoming decoupled from the convection. Subsequently, TS 01W quickly weakened over water due to strong vertical wind shear and cool sea surface temperatures and the final warning was issued at 1200Z, just 12 hours later.

2) No damage reports were received, with closest point of approach to Guam being 115 nm to the east-northeast and 85 nm to the southeast of Saipan.

\*Named by WMO designated RSMC

|          |     |       |        | Stati | istic | s fo  | r JT\ | WC ( | on T | S01 | W   |     |    |         |         |         |         |         |    |     |
|----------|-----|-------|--------|-------|-------|-------|-------|------|------|-----|-----|-----|----|---------|---------|---------|---------|---------|----|-----|
|          |     |       |        |       |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
|          | WRN | BEST  | TRACK  |       | POS   | SITIC | N EF  | RROI | RS   |     |     |     | WI | ND      | ERI     | ROF     | RS      |         |    |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00    | 12    | 24    | 36   | 48   | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96 | 120 |
| 03011106 |     | 1.9N  | 179.8W | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011112 |     | 1.9N  | 179.6E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011118 |     | 1.9N  | 179.0E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011200 |     | 1.8N  | 178.5E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011206 |     | 1.6N  | 178.0E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011212 |     | 1.3N  | 177.6E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011218 |     | 1.6N  | 177.2E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011300 |     | 1.9N  | 176.8E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011306 |     | 2.4N  | 176.2E | 15    |       |       |       |      |      |     |     |     |    |         |         |         |         |         |    |     |
| 03011312 | 1   | 3.1N  | 175.1E | 15    | 102   |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011318 | 2   | 4.1N  | 173.4E | 20    | 123   |       |       |      |      |     |     |     | -5 |         |         |         |         |         |    |     |
| 03011400 | 3   | 5.1N  | 171.5E | 25    | 61    |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011406 | 4   | 5.7N  | 169.7E | 25    | 69    |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011412 | 5   | 5.8N  | 168.2E | 25    | 224   |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011418 | 6   | 5.6N  | 166.8E | 25    | 204   |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011500 | 7   | 5.4N  | 165.6E | 25    | 23    |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011506 | 8   | 6.0N  | 164.1E | 25    | 45    |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011512 | 9   | 6.7N  | 162.5E | 25    | 46    |       |       |      |      |     |     |     | 0  |         |         |         |         |         |    |     |
| 03011518 | 10  | 7.3N  | 160.8E | 30    | 8     | 8     | 24    | 43   | 88   | 221 |     |     | 0  | 5       | 10      | 10      | 15      | 10      |    |     |
| 03011600 | 11  | 7.9N  | 159.2E | 30    | 26    | 22    | 49    | 84   | 114  | 207 |     |     | 0  | 5       | 5       | 10      | 5       | 0       |    |     |
| 03011606 | 12  | 8.5N  | 157.8E | 30    | 21    | 12    | 31    | 48   | 69   | 211 |     |     | 5  | 0       | 0       | 5       | 0       | -<br>10 |    |     |
| 03011612 | 13  | 8.8N  | 156.3E | 30    | 37    | 35    | 48    | 69   | 21   |     |     |     | 0  | -5      | -5      | -<br>15 | -<br>20 |         |    |     |
| 03011618 | 14  | 9.4N  | 154.7E | 30    | 33    | 83    | 103   | 122  | 69   | 216 |     |     | 0  | -5      | -5      | -<br>10 | -<br>15 | 0       |    |     |
| 03011700 | 15  | 10.0N | 153.0E | 35    | 5     | 27    | 59    | 25   | 123  | 197 | 206 |     | 0  | 5       | 0       | 0       | 0       | 15      | 15 |     |
| 03011706 | 16  | 10.9N | 151.4E | 35    | 18    | 25    | 41    | 55   | 183  | 430 |     |     | 0  | 0       | -5      | -<br>10 | 0       | 15      |    |     |
| 03011712 | 17  | 11.7N | 149.9E | 30    | 26    | 65    | 63    | 65   | 180  | 471 | 559 |     | 0  | -5      | -<br>10 | -<br>15 | 0       | 10      | 0  |     |
| 03011718 | 18  | 12.4N | 148.5E | 35    | 5     | 19    | 61    | 168  | 266  | 411 |     |     | 0  | -<br>10 | -<br>15 | -5      | 0       | 15      |    |     |
| 03011800 | 19  | 13.2N | 147.4E | 40    | 18    | 89    | 188   | 246  | 267  | 290 |     |     | 0  | 0       | 5       | 10      | 5       | 15      |    |     |

| 03011806 | 20 | 13.7N | 146.7E  | 45 | 16 | 52  | 136 | 171 | 224 | 205 |     | 0  | 0       | 5  | 5       | 5       | 15 |   |  |
|----------|----|-------|---------|----|----|-----|-----|-----|-----|-----|-----|----|---------|----|---------|---------|----|---|--|
| 03011812 | 21 | 14.1N | 146.8E  | 45 | 13 | 93  | 139 | 168 | 212 | 69  |     | 0  | -<br>10 | -5 | -<br>10 | -<br>10 | 5  |   |  |
| 03011818 | 22 | 14.3N | 147.4E  | 50 | 8  | 17  | 55  | 112 | 127 |     |     | -5 | -5      | -5 | -5      | -5      |    |   |  |
| 03011900 | 23 | 14.5N | 148.2E  | 50 | 8  | 42  | 108 | 169 | 146 |     |     | 0  | 5       | 0  | 0       | 5       |    |   |  |
| 03011906 | 24 | 14.8N | 149.0E  | 45 | 13 | 79  | 164 | 229 | 199 |     |     | 0  | 0       | 0  | 0       | 5       |    |   |  |
| 03011912 | 25 | 15.4N | 149.9E  | 40 | 5  | 63  | 118 | 80  | 13  |     |     | 0  | -5      | -5 | 0       | 0       |    |   |  |
| 03011918 | 26 | 16.1N | 150.9E  | 40 | 0  | 55  | 99  | 46  |     |     |     | 0  | 0       | 0  | 5       |         |    |   |  |
| 03012000 | 27 | 16.7N | 152.0E  | 40 | 0  | 57  | 49  | 49  |     |     |     | 0  | 0       | 5  | 5       |         |    |   |  |
| 03012006 | 28 | 17.2N | 153.4E  | 35 | 12 | 47  | 24  |     |     |     |     | 0  | 0       | 5  |         |         |    |   |  |
| 03012012 | 29 | 17.6N | 154.8E  | 35 | 28 | 25  | 62  |     |     |     |     | -5 | 0       | 0  |         |         |    |   |  |
| 03012018 | 30 | 18.0N | 155.9E  | 30 | 18 | 105 |     |     |     |     |     | 0  | 5       |    |         |         |    |   |  |
| 03012100 | 31 | 18.2N | 156.3E  | 25 | 12 | 19  |     |     |     |     |     | 0  | 0       |    |         |         |    |   |  |
| 03012106 |    | 18.4N | 156.6E  | 20 |    |     |     |     |     |     |     |    |         |    |         |         |    |   |  |
| 03012112 |    | 18.5N | 156.9E  | 20 |    |     |     |     |     |     |     |    |         |    |         |         |    |   |  |
|          |    |       | AVERAGE |    | 40 | 47  | 81  | 108 | 144 | 266 | 383 | 1  | 3       | 5  | 7       | 6       | 10 | 8 |  |
|          |    |       | BIAS    |    |    |     |     |     |     |     |     | 0  | -1      | -1 | -1      | -1      | 8  | 8 |  |
|          |    |       | # CASES |    | 31 | 22  | 20  | 18  | 16  | 11  | 2   | 31 | 22      | 20 | 18      | 16      | 11 | 2 |  |

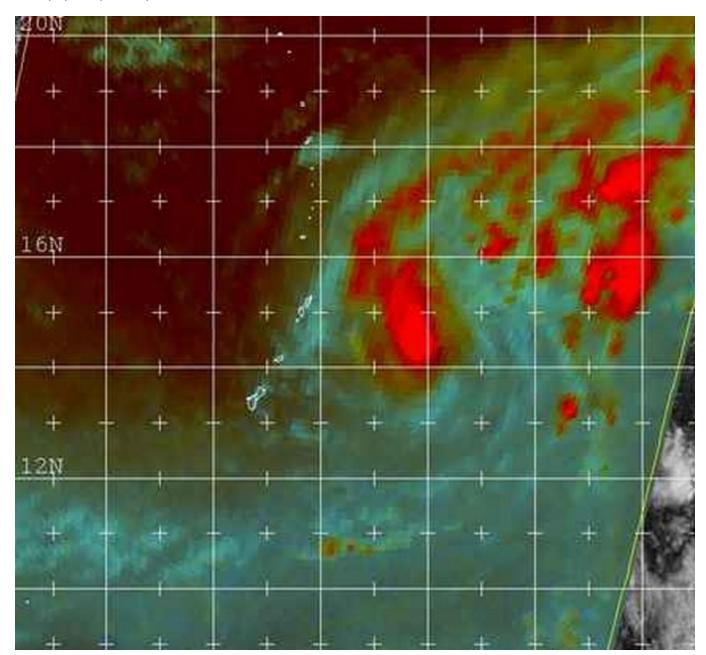
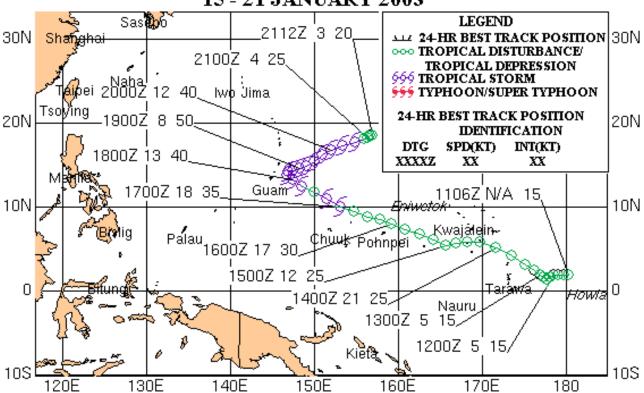
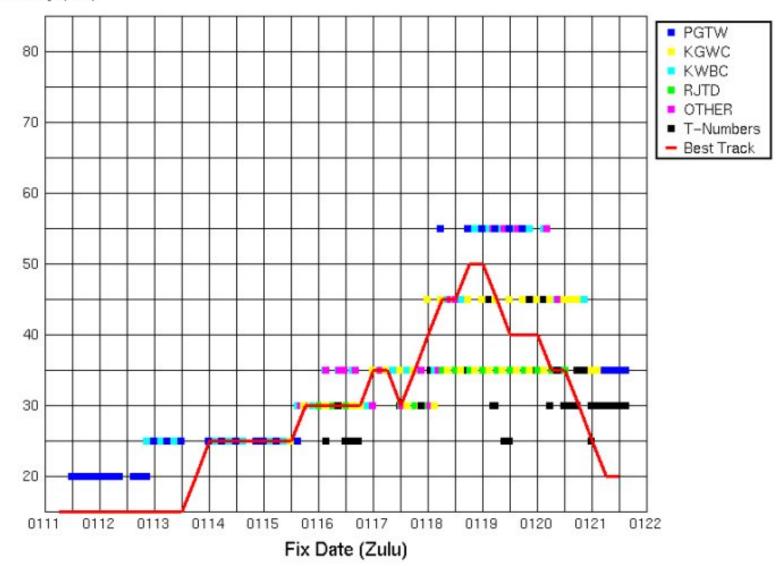


Figure 1-01W-1. 182230Z January 2003 GMS-5 color composite SSM/I imagery of TY 01W (Yanyan), located 120 nm east of the Guam, with an estimated intensity of 50 knots.

#### TROPICAL STORM 01W (YAN-YAN) 15 - 21 JANUARY 2003



# Time Intensity for 01W



## Super Typhoon (STY) 02W (Kujira)



First Poor: 2100Z 06 Apr 03

First Fair : 1600Z 08 Apr 03

First TCFA: 2200Z 08 Apr 03

First Warning: 0000Z 09 Apr 03

Last Warning: 0600Z 22 Apr 03

Max Intensity: 135 kts, gusts to 165 kts

Landfall: Ushibuka, Japan

Total Warnings: 66

#### Remarks:

1) Super Typhoon (STY) 02W was initially detected as a broad area of convection on 06 April, 2003 south of Pohnpei and very close to the equator. Multiple convection centers were monitored in this region for almost 48 hours before significant development began. The initial warning was issued within 8 hours after JTWC designated the suspect area as having fair potential for development.

Although cross equatorial upper level outflow was noted for STY 02W from the first warning, the cyclone intensified slowly while the low level circulation center (LLCC) remained exposed to the east of the deep convection during this period. The cyclone tracked slowly northward until 0000Z on 11 April, an then began to move westward under the steering influence of the subtropical ridge north of the cyclone. Concurrently, the cyclone became more vertically stacked, and began to intensify at a higher rate.

By 1800Z on 12 April, STY 02W was classified as a typhoon with a banding eye. Radial outflow was very pronounced at this time and a period of greater than climatological development (> 1 Dvorak T-number/day) ensued, with an increase of 2 Dvorak T-number in the 36 hour period between 0600Z on 13 April and 1800Z on 14 April.

After 1800Z on 14 April, a shortwave trough moving east from China altered the steering flow allowing the cyclone to move more west-northwestward. The cyclone also attained maximum intensity of 135 knots during this period of nowrthest movement with concentric eyewall formation noted in microwave and infrared satellite data.

After 1200Z on 16 April, STY 02W begun weaken in an apparent response to increasing vertical wind shear. After 1800Z on 18 April, the cyclone began to reintensify after it turned more west and it reached a peak intensity of 125 knots between 0600Z and 1200Z on 18 April before weakening again.

The cyclone once again began to move more poleward and weaken as outflow became restricted in both the equatorward and poleward directions. A third reintensification which occurred after 0000Z on 20 April was caused by temporarily improved poleward outflow, and produced a tertiary peak intensity of 100 knots. After 0000Z on 21 April, the cyclone then began to rapidly weaken while moving poleward into a region of increased vertical wind shear.

By 0000Z on 22 April, track speed for STY 02W began to decrease, eventually causing the system to become quasistationary within a break in the subtropical ridge. 36 hour later the cyclone began to accelerate toward the northeast in an environment of strong vertical wind shear causing the LLCC to become fully exposed to the southwest of the rapidly moving upper level circulation. Extratropical transition occurred during this northeast movement and the final warning on STY 02W was issued on 0600Z on 25 April.

2) Reports indicated two casualties on Pohnpei due to STY 02W. All other damage reports received indicated only minor damage to buildings and crops.

\*Named by WMO designated RSMC

|          |  |      |          | Statis | stic | s f | or J | TWC        | on  | STY | 02W | /   |          |        |    |     |    |    |    |     |
|----------|--|------|----------|--------|------|-----|------|------------|-----|-----|-----|-----|----------|--------|----|-----|----|----|----|-----|
|          |  |      |          |        |      |     |      |            |     |     |     |     |          |        |    |     |    |    |    |     |
|          | MON  | DEST | TD 1 01/ |        | 50   | OIT | 1011 | <b>EDD</b> | 000 |     |     |     | \ A // \ | - ID I |    | 0.0 |    |    |    |     |
|          | WRN BEST TRACK         POSITION ERRORS         WIND ERRORS           TG         NO. LAT LONG         wind 00 12 24 36 48 72 96 120 00 12 24 36 48 72 96 12 |      |          |        |      |     |      |            |     |     |     |     |          |        |    |     |    |    |    |     |
| DTG      | NO.  | LAT  | LONG     | wind   | 00   | 12  | 24   | 36         | 48  | 72  | 96  | 120 | 00       | 12     | 24 | 36  | 48 | 72 | 96 | 120 |
| 03040806 |  | 2.6N | 158.8E   | 15     |      |     |      |            |     |     |     |     |          |        |    |     |    |    |    |     |
| 03040812 |  | 3.0N | 159.5E   | 25     |      |     |      |            |     |     |     |     |          |        |    |     |    |    |    |     |
| 03040818 |  | 3.4N | 160.0E   | 25     |      |     |      |            |     |     |     |     |          |        |    |     |    |    |    |     |
| 03040900 | 1  | 3.7N | 160.2E   | 30     | 48   | 99  | 135  | 137        | 102 | 122 |     |     | 0        | 0      | 0  | 5   | 15 | 10 |    |     |
| 03040906 | 2  | 4.1N | 160.4E   | 35     | 23   | 48  | 63   | 51         | 55  | 126 | 260 | 354 | 0        | 5      | 5  | 10  | 20 | 15 | 20 | 5   |
| 03040912 | 3  | 4.6N | 160.6E   | 35     | 5    | 35  | 42   | 36         | 54  | 136 | 222 | 390 | 0        | 0      | 5  | 10  | 20 | 15 | 0  | -30 |

|          |    |       |        |     |    |    |    |    |     |     |     |     | _       |         |         |         |         |         |         |           |
|----------|----|-------|--------|-----|----|----|----|----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----------|
| 03040918 | 4  | 5.4N  | 160.6E |     |    | 60 |    | 63 | 85  | 143 |     | 108 |         | 10      | 15      | 20      | 15      | 10      | 20      | -5<br>-15 |
| 03041000 | 5  | 6.5N  | 160.4E | 40  |    |    | 32 | 53 | 77  | 128 | 127 | 113 | U       | 5       | 10      | 15      | 5       | 10      | 5       | -15       |
| 03041006 | 6  | 7.5N  | 159.7E | 40  | 8  | 21 | 35 | 55 | 84  | 114 | 173 | 317 | 0       | 5       | 10      | 5       | 5       | 5       | 30      | -65       |
| 03041012 | 7  | 8.1N  | 159.0E | 40  | 0  | 8  | 19 | 38 | 68  | 81  | 152 | 338 | 0       | 5       | 10      | 0       | 5       | -5      | -<br>40 | -65       |
| 03041018 | 8  | 8.6N  | 158.3E | 40  | 21 | 35 | 51 | 83 | 96  | 103 | 189 | 306 | 0       | 5       | 0       | 0       | -5      | -<br>10 | -<br>45 | -45       |
| 03041100 | 9  | 9.1N  | 157.6E | 40  | 33 | 51 | 66 | 84 | 93  | 119 | 219 | 324 | 0       | 5       | -5      | 5       | 5       | -<br>15 | -<br>35 | -30       |
| 03041106 | 10 | 9.6N  | 156.8E | 40  | 5  | 6  | 18 | 25 | 18  | 6   | 82  | 164 | 0       | -5      | -5      | -5      | 5       | -<br>25 | -<br>50 | -65       |
| 03041112 | 11 | 10.0N | 156.0E | 40  | 5  | 6  | 8  | 18 | 17  | 19  | 104 | 155 | 0       | -<br>10 | -5      | -5      | -5      | -<br>35 | -<br>50 | -60       |
| 03041118 | 12 | 10.2N | 155.2E | 50  | 11 | 22 | 38 | 36 | 35  | 30  | 138 | 158 | -<br>10 | -<br>10 | -<br>15 | -5      | 0       | -<br>30 | -<br>35 | -15       |
| 03041200 | 13 | 10.2N | 154.3E | 55  | 8  | 22 | 30 | 22 | 19  | 65  | 158 | 135 | 0       | 5       | 5       | 5       | 0       | -<br>20 | -<br>25 | 0         |
| 03041206 | 14 | 10.2N | 153.4E | 55  | 6  | 13 | 22 | 25 | 31  | 43  | 67  | 51  | 0       | -5      | 5       | 5       | -<br>10 | -<br>20 | -<br>30 | -5        |
| 03041212 | 15 | 10.2N | 152.5E | 55  | 8  | 56 | 56 | 38 | 36  | 38  |     |     | 0       | -5      | -5      | -<br>10 | -<br>20 | -<br>25 |         |           |
| 03041218 | 16 | 10.1N | 151.6E | 65  | 16 | 17 | 25 | 22 | 25  | 46  | 41  | 49  | 0       | 5       | 5       | -<br>10 | -<br>20 | -<br>25 | -5      | 5         |
| 03041300 | 17 | 10.1N | 150.7E | 65  | 11 | 8  | 8  | 21 | 24  | 18  | 47  | 48  | 0       | -5      | -<br>10 | -<br>25 | -<br>35 | -<br>40 | -<br>20 | -20       |
| 03041306 | 18 | 10.2N | 149.8E | 65  | 0  | 24 | 36 | 37 | 24  | 29  | 76  | 160 | 0       | -5      | -<br>20 | -<br>35 | -<br>35 | -<br>30 | -5      | -20       |
| 03041312 | 19 | 10.2N | 149.0E | 75  | 8  | 30 | 32 | 26 | 13  | 25  | 132 | 170 | 0       | -<br>10 | -<br>20 | -<br>30 | -<br>25 | -<br>20 | 15      | -15       |
| 03041318 | 20 | 10.3N | 148.2E | 75  | 8  | 8  | 6  | 6  | 6   | 35  | 163 | 159 | 0       | -<br>20 | -<br>30 | -<br>30 | -<br>30 | -5      | 10      | -15       |
| 03041400 | 21 | 10.4N | 147.3E | 90  | 5  | 13 | 0  | 21 | 19  | 41  | 167 | 121 | 0       | -<br>15 | -<br>20 | -<br>15 | -<br>20 | 10      | 10      | 10        |
| 03041406 | 22 | 10.6N | 146.3E | 100 | 0  | 0  | 6  | 13 | 12  | 60  | 138 | 138 | 0       | -<br>15 | -<br>10 | -<br>10 | -<br>10 | 15      | 0       | 20        |
| 03041412 | 23 | 10.7N | 145.2E | 110 | 8  | 8  | 18 | 30 | 8   | 59  | 146 | 155 | 0       | 0       | 5       | 0       | 5       | 25      | 0       | 25        |
| 03041418 | 24 | 11.1N | 143.9E | 120 | 5  | 17 | 38 | 43 | 27  | 78  |     |     | 0       | 5       | 5       | 0       | 15      | 25      |         |           |
| 03041500 | 25 | 11.4N | 142.5E | 125 | 11 | 17 | 40 | 25 | 42  | 105 | 102 | 74  | 0       | 5       | 0       | 10      | 20      | 15      | 20      | 45        |
| 03041506 | 26 | 11.9N | 141.1E | 125 | 11 | 25 | 31 | 31 | 72  | 108 | 93  | 72  | 0       | 0       | 0       | 20      | 20      | 0       | 15      | 20        |
| 03041512 | 27 | 12.3N | 139.6E | 125 | 5  | 19 | 25 | 46 | 69  | 104 | 69  | 67  | 0       | -5      | 0       | 15      | 20      | -5      | 20      | 10        |
| 03041518 | 28 | 12.6N | 138.3E | 130 | 5  | 19 | 35 | 81 | 108 | 144 |     |     | 0       | -5      | 15      | 15      | 20      | 0       |         |           |
| 03041600 | 29 | 13.0N | 137.0E | 135 | 0  | 13 | 17 | 72 | 114 | 138 | 161 | 216 | 0       | 0       | 10      | 20      | 10      | 5       | 35      | 25        |

| 03041606 | 30 | 13.4N | 136.1E | 135 | 0  | 12 | 45 | 73  | 115 | 121 | 130 | 222 | 0       | 15      | 15      | 20      | 0       | 15      | 10      | -10 |
|----------|----|-------|--------|-----|----|----|----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
| 03041612 | 31 | 13.8N | 135.2E | 130 | 5  | 31 | 71 | 106 | 136 | 139 | 102 | 220 | 0       | 10      | 15      | 0       | -<br>15 | 10      | -5      | -10 |
| 03041618 | 32 | 14.0N | 134.4E | 115 | 5  | 48 | 80 | 107 | 139 | 125 | 138 | 288 | 0       | 0       | 0       | -<br>25 | -<br>45 | -<br>25 | -<br>45 | -20 |
| 03041700 | 33 | 14.0N | 133.6E | 115 | 0  | 36 | 57 | 81  | 105 | 94  | 89  | 222 | -<br>10 | 0       | -<br>15 | -<br>45 | -<br>50 | -<br>30 | -<br>35 | 0   |
| 03041706 | 34 | 13.7N | 132.8E | 110 | 11 | 24 | 59 | 69  | 72  | 70  | 96  | 120 | -5      | -5      | -<br>35 | -<br>45 | -<br>40 | -<br>40 | -<br>30 | 5   |
| 03041712 | 35 | 13.6N | 132.0E | 105 | 5  | 30 | 54 | 78  | 81  | 46  |     |     | 0       | -<br>15 | -<br>35 | -<br>35 | -<br>25 | -<br>45 |         |     |
| 03041718 | 36 | 13.5N | 131.2E | 105 | 6  | 26 | 47 | 64  | 61  | 61  | 206 | 276 | 0       | -<br>30 | -<br>30 | -<br>30 | -<br>25 | -<br>45 | -<br>30 | 5   |
| 03041800 | 37 | 13.5N | 130.6E | 115 | 8  | 26 | 41 | 35  | 18  | 67  | 166 | 218 | 0       | -<br>20 | -<br>20 | -<br>15 | -<br>20 | -<br>45 | -<br>10 | 15  |
| 03041806 | 38 | 13.5N | 130.0E | 125 | 6  | 18 | 38 | 35  | 36  | 74  | 170 | 195 | 0       | 5       | 10      | 10      | -5      | -<br>20 | 25      | 10  |
| 03041812 | 39 | 13.6N | 129.5E | 125 | 6  | 24 | 31 | 13  | 27  | 74  |     |     | 0       | 10      | 15      | 10      | -<br>20 | -<br>20 |         |     |
| 03041818 | 40 | 13.9N | 129.1E | 120 | 0  | 18 | 17 | 17  | 35  | 62  | 144 | 179 | 0       | 0       | 5       | -<br>20 | -<br>35 | -<br>25 | -5      | -5  |
| 03041900 | 41 | 14.2N | 128.7E | 115 | 8  | 6  | 18 | 34  | 70  | 96  | 143 | 214 | 0       | 5       | 0       | -<br>30 | -<br>40 | -5      | 0       | -10 |
| 03041906 | 42 | 14.7N | 128.3E | 105 | 0  | 0  | 17 | 38  | 54  | 87  | 123 | 331 | 0       | 0       | -<br>20 | -<br>35 | -<br>40 | -5      | 0       | -5  |
| 03041912 | 43 | 15.2N | 127.8E | 95  | 8  | 12 | 18 | 46  | 48  | 91  | 165 | 417 | 0       | 0       | -<br>30 | -<br>40 | -<br>35 | -5      | -5      | -10 |
| 03041918 | 44 | 15.7N | 127.3E | 90  | 5  | 13 | 21 | 32  | 62  | 80  | 178 | 537 | 0       | -<br>20 | -<br>35 | -<br>40 | -<br>30 | -<br>10 | -<br>10 | -15 |
| 03042000 | 45 | 16.2N | 126.6E | 85  | 11 | 8  | 32 | 48  | 57  | 74  | 198 | 677 | 0       | -<br>25 | -<br>35 | -<br>30 | -<br>10 | 0       | -<br>10 | -15 |
| 03042006 | 46 | 16.7N | 126.1E | 95  | 0  | 17 | 21 | 64  | 69  | 98  | 229 | 819 | 0       | -<br>15 | -<br>20 | -<br>15 | 0       | 5       | 5       | 5   |
| 03042012 | 47 | 17.2N | 125.6E | 100 | 6  | 25 | 54 | 67  | 115 | 123 | 309 | 991 | 0       | -5      | 0       | 20      | 15      | 10      | 5       | 0   |
| 03042018 | 48 | 17.9N | 125.1E | 100 | 5  | 26 | 6  | 13  | 36  | 51  | 298 |     | 0       | 5       | 15      | 25      | 15      | 10      | 0       |     |
| 03042100 | 49 | 18.4N | 124.6E | 100 | 6  | 31 | 26 | 64  | 50  | 91  | 463 |     | 0       | 5       | 25      | 25      | 20      | 10      | 0       |     |
| 03042106 | 50 | 18.7N | 124.3E | 95  | 0  | 41 | 43 | 62  | 54  | 152 | 723 |     |         | 10      | 25      | 15      | 20      | 5       | 5       |     |
| 03042112 | 51 | 19.2N | 124.4E | 85  | 11 | 6  | 38 | 17  | 30  | 182 | 835 |     | 0       | 20      | 15      | 15      | 10      | 0       | 0       |     |
| 03042118 | 52 | 19.7N | 124.0E | 75  | 8  | 43 | 59 | 90  | 94  | 69  |     |     | 0       | 10      | 10      | 10      | 5       | 0       |         |     |
| 03042200 | 53 | 19.9N | 123.5E | 55  | 16 | 39 | 37 | 57  | 78  | 240 |     |     | 0       | -5      | -5      | -<br>10 | -<br>10 | -<br>15 |         |     |
| 03042206 | 54 | 20.3N | 123.2E | 50  | 5  | 0  | 31 | 55  | 53  | 391 |     |     | 5       | 0       | 5       | 0       | -<br>10 | -<br>10 |         |     |

| 1 31 \   | ĺ  | · 3 / |         |    |    |    |     |     |     |     |     |     |    |    |         |         |         |    |    |    |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|-----|-----|----|----|---------|---------|---------|----|----|----|
| 03042212 | 55 | 20.7N | 123.3E  | 45 | 0  | 53 | 95  | 88  | 79  | 239 |     |     | 10 | 10 | 5       | 0       | -5      | -5 |    |    |
| 03042218 | 56 | 20.8N | 122.9E  | 45 | 11 | 40 | 48  | 81  | 64  |     |     |     | -5 | 0  | -5      | -<br>10 | -<br>10 |    |    |    |
| 03042300 | 57 | 20.8N | 122.5E  | 35 | 5  | 29 | 51  | 142 | 355 |     |     |     | 0  | -5 | -<br>10 | -<br>10 | -<br>15 |    |    |    |
| 03042306 | 58 | 20.9N | 122.4E  | 35 | 13 | 38 | 73  | 246 |     |     |     |     | 0  | -5 | -<br>10 | -<br>15 |         |    |    |    |
| 03042312 | 59 | 21.1N | 122.4E  | 35 | 8  | 25 | 133 | 358 |     |     |     |     | 0  | -5 | -<br>10 | -<br>15 |         |    |    |    |
| 03042318 | 60 | 21.6N | 122.5E  | 35 | 11 | 50 | 229 | 540 |     |     |     |     | 0  | -5 | -<br>10 | -<br>10 |         |    |    |    |
| 03042400 | 61 | 22.1N | 122.8E  | 35 | 0  | 58 | 189 | 404 |     |     |     |     | 0  | 5  | 0       | 0       |         |    |    |    |
| 03042406 | 62 | 23.0N | 123.2E  | 35 | 5  | 89 | 231 |     |     |     |     |     | 0  | 0  | 0       |         |         |    |    |    |
| 03042412 | 63 | 24.8N | 124.0E  | 35 | 0  | 34 | 139 |     |     |     |     |     | 0  | 0  | 10      |         |         |    |    |    |
| 03042418 | 64 | 26.8N | 125.4E  | 35 | 0  | 55 |     |     |     |     |     |     | 0  | 5  |         |         |         |    |    |    |
| 03042500 | 65 | 29.0N | 127.3E  | 35 | 0  | 60 |     |     |     |     |     |     | 0  | 5  |         |         |         |    |    |    |
| 03042506 | 66 | 32.1N | 130.1E  | 30 | 11 |    |     |     |     |     |     |     | 0  |    |         |         |         |    |    |    |
| 03042512 |    | 34.2N | 134.0E  | 30 |    |    |     |     |     |     |     |     |    |    |         |         |         |    |    |    |
|          |    |       | AVERAGE |    | 8  | 28 | 50  | 73  | 64  | 96  | 184 | 250 | 1  | 7  | 12      | 16      | 17      | 16 | 17 | 19 |
|          |    |       | BIAS    |    |    |    |     |     |     |     |     |     | 0  | -1 | -3      | -6      | -7      | -8 | -7 | -9 |
|          |    |       | # CASES |    | 66 | 65 | 63  | 61  | 57  | 55  | 45  | 41  | 66 | 65 | 63      | 61      | 57      | 55 | 45 | 41 |

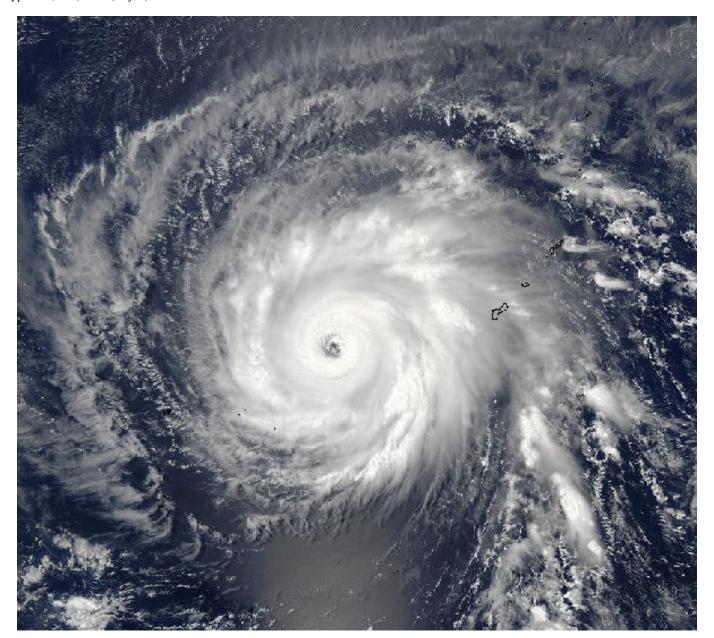


Figure 1-02W-3. 150350Z April 2003 MODIS true-color image of TY 02W (Kujira), located 180nm southwest of Guam, with an intensity of 125 knots.

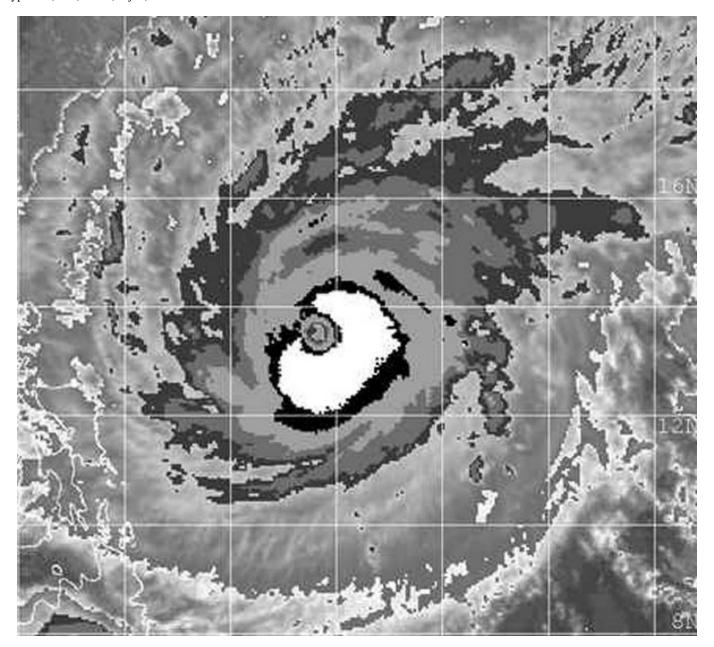
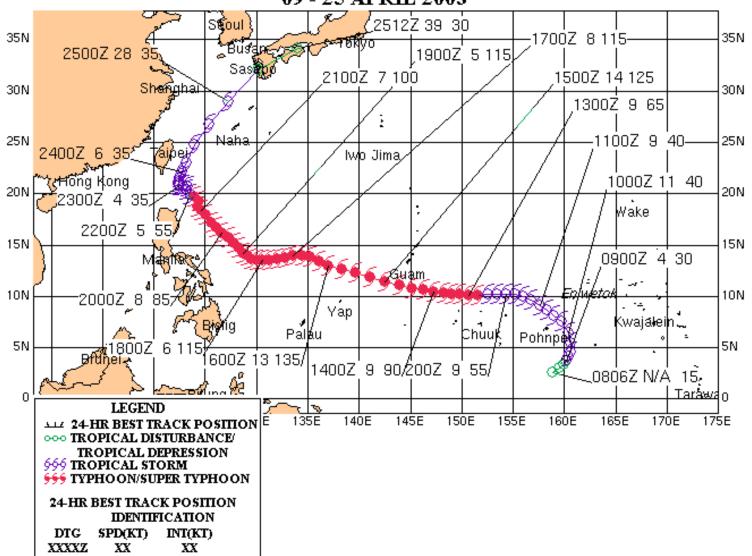
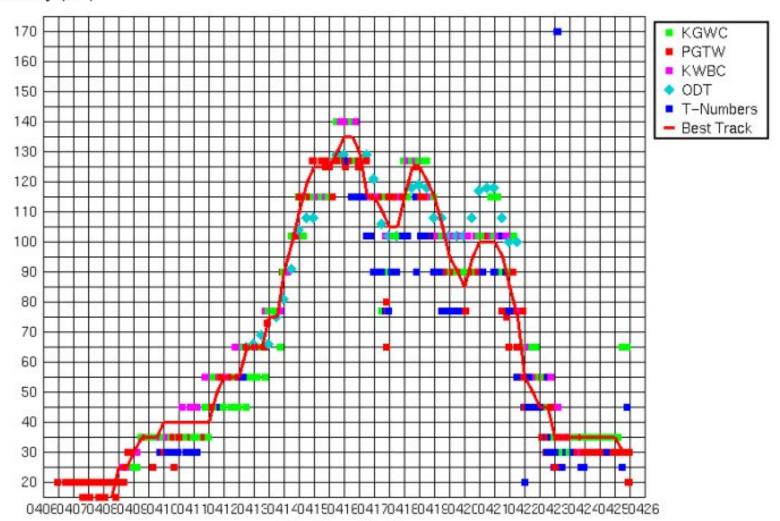


Figure 1-02W-1. 181049Z April 2003 GMS-5 enhanced infrared imagery of TY 02W (Kujira), located 480 nm east of the Luzon, with an peak intensity of 125 knots.

#### SUPER TYPHOON 02W (KUJIRA) 09 - 25 APRIL 2003



# Time Intensity for 02W



Fix Date (Zulu)

## Super Typhoon (STY) 02W (Kujira)



First Poor : 2100Z 06 Apr 03

First Fair: 1600Z 08 Apr 03

First TCFA: 2200Z 08 Apr 03

First Warning: 0000Z 09 Apr 03

Last Warning: 0600Z 22 Apr 03

Max Intensity: 135 kts, gusts to 165 kts

Landfall: Ushibuka, Japan

Total Warnings: 66

#### Remarks:

1) Super Typhoon (STY) 02W was initially detected as a broad area of convection on 06 April, 2003 south of Pohnpei and very close to the equator. Multiple convection centers were monitored in this region for almost 48 hours before significant development began. Subsequently, the initial warning was issued within 8 hours after JTWC designated the suspect area of having fair potential for development.

Although cross equatorial upper level outflow was noted for STY 02W from the first warning, the cyclone intensified slowly while the low level circulation center (LLCC) remained exposed to the east of the deep convection during this period. The cyclone tracked slowly northward until 0000Z on 11 April, an then began to move westward under the steering influence of the subtropical ridge north of the cyclone. Concurrently, the cyclone became more vertically stacked, and began to intensify at a higher rate.

By 1800Z on 12 April, STY 02W was classified as a typhoon with a banding eye. Radial outflow was very pronounced at this time and a period of greater than climatological development (> 1 Dvorak T-number/day) ensued, with an increase of 2 Dvorak T-number in the 36 hour period between 0600Z on 13 April and 1800Z on 14 April.

After 1800Z on 14 April, a shortwave trough moving east from China altered the steering flow allowing the cyclone to move more west-northwestward. The cyclone also attained maximum intensity of 135 knots during this period of nowrthest movement with concentric eyewall formation noted in microwave and infrared satellite data.

After 1200Z on 16 April, STY 02W begun weaken in an apparent response to increasing vertical wind shear. After 1800Z on 18 April, the cyclone began to reintensify after it turned more west and it reached a peak intensity of 125 knots between 0600Z and 1200Z on 18 April before weakening again.

Subsequently, the cyclone once again began to move more poleward and weaken as outflow became restricted in both the equatorward and poleward directions. A third reintensification which occurred after 0000Z on 20 April was caused by temporarily improved poleward outflow, and produced a tertiary peak intensity of 100 knots. After 0000Z on 21 April, the cyclone then began to rapidly weaken while moving poleward into a region of increased vertical wind shear.

By 0000Z on 22 April, track speed for STY 02W began to decrease, eventually causing the system to become quasistationary within a break in the subtropical ridge. 36 hour later the cyclone began to accelerate toward the northeast in an environment of strong vertical wind shear causing the LLCC to remain fully exposed to the southwest of the rapidly moving upper level circulation. Extratropical transition occurred during this northeast movement and the final warning on STY 02W was issued on 0600Z on 25 April.

2) Reports indicated two casualties on Pohnpei due to STY 02W. All other damage reports received indicated only minor damage to buildings and crops.

\*Named by WMO designated RSMC

|          |     |      |        | Statis | stic | s f | or J | TWC | on  | STY | 02W | I   |     |      |    |    |    |    |    |     |
|----------|-----|------|--------|--------|------|-----|------|-----|-----|-----|-----|-----|-----|------|----|----|----|----|----|-----|
|          | WRN | BEST | TRACK  |        | ΡΩ   | SIT | ION  | ERR | ORS |     |     |     | WII | ND F | RR | OR | S  |    |    |     |
| DTG      | NO. | LAT  | LONG   | wind   |      | 12  |      | 36  | 48  | 72  | 96  | 120 | 00  |      | 24 | 36 | 48 | 72 | 96 | 120 |
| 03040806 |     | 2.6N | 158.8E | 15     |      |     |      |     |     |     |     |     |     |      |    |    |    |    |    |     |
| 03040812 |     | 3.0N | 159.5E | 25     |      |     |      |     |     |     |     |     |     |      |    |    |    |    |    |     |
| 03040818 |     | 3.4N | 160.0E | 25     |      |     |      |     |     |     |     |     |     |      |    |    |    |    |    |     |
| 03040900 | 1   | 3.7N | 160.2E | 30     | 48   | 99  | 135  | 137 | 102 | 122 |     |     | 0   | 0    | 0  | 5  | 15 | 10 |    |     |
| 03040906 | 2   | 4.1N | 160.4E | 35     | 23   | 48  | 63   | 51  | 55  | 126 | 260 | 354 | 0   | 5    | 5  | 10 | 20 | 15 | 20 | 5   |
| 03040912 | 3   | 4.6N | 160.6E | 35     | 5    | 35  | 42   | 36  | 54  | 136 | 222 | 390 | 0   | 0    | 5  | 10 | 20 | 15 | 0  | -30 |
| 03040918 | 4   | 5.4N | 160.6E | 35     | 8    | 60  | 48   | 63  | 85  | 143 | 150 | 108 | 5   | 10   | 15 | 20 | 15 | 10 | 20 | -5  |
| 03041000 | 5   | 6.5N | 160.4E | 40     | 18   | 19  | 32   | 53  | 77  | 128 | 127 | 113 | 0   | 5    | 10 | 15 | 5  | 10 | 5  | -15 |

| 03041006 | 6  | 7.5N  | 159.7E | 40  | 8  | 21 | 35 | 55  | 84  | 114 | 173 | 317 | 0       | 5       | 10      | 5       | 5       | 5       | -<br>30 | -65 |
|----------|----|-------|--------|-----|----|----|----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
| 03041012 | 7  | 8.1N  | 159.0E | 40  | 0  | 8  | 19 | 38  | 68  | 81  | 152 | 338 | 0       | 5       | 10      | 0       | 5       | -5      | -<br>40 | -65 |
| 03041018 | 8  | 8.6N  | 158.3E | 40  | 21 | 35 | 51 | 83  | 96  | 103 | 189 | 306 | 0       | 5       | 0       | 0       | -5      | -<br>10 | -<br>45 | -45 |
| 03041100 | 9  | 9.1N  | 157.6E | 40  | 33 | 51 | 66 | 84  | 93  | 119 | 219 | 324 | 0       | 5       | -5      | 5       | 5       | -<br>15 | -<br>35 | -30 |
| 03041106 | 10 | 9.6N  | 156.8E | 40  | 5  | 6  | 18 | 25  | 18  | 6   | 82  | 164 | 0       | -5      | -5      | -5      | 5       | -<br>25 | -<br>50 | -65 |
| 03041112 | 11 | 10.0N | 156.0E | 40  | 5  | 6  | 8  | 18  | 17  | 19  | 104 | 155 | 0       | -<br>10 | -5      | -5      | -5      | -<br>35 | -<br>50 | -60 |
| 03041118 | 12 | 10.2N | 155.2E | 50  | 11 | 22 | 38 | 36  | 35  | 30  | 138 | 158 | -<br>10 | -<br>10 | -<br>15 | -5      | 0       | -<br>30 | -<br>35 | -15 |
| 03041200 | 13 | 10.2N | 154.3E | 55  | 8  | 22 | 30 | 22  | 19  | 65  | 158 | 135 | 0       | 5       | 5       | 5       | 0       | -<br>20 | -<br>25 | 0   |
| 03041206 | 14 | 10.2N | 153.4E | 55  | 6  | 13 | 22 | 25  | 31  | 43  | 67  | 51  | 0       | -5      | 5       | 5       | -<br>10 | -<br>20 | -<br>30 | -5  |
| 03041212 | 15 | 10.2N | 152.5E | 55  | 8  | 56 | 56 | 38  | 36  | 38  |     |     | 0       | -5      | -5      | -<br>10 | -<br>20 | -<br>25 |         |     |
| 03041218 | 16 | 10.1N | 151.6E | 65  | 16 | 17 | 25 | 22  | 25  | 46  | 41  | 49  | 0       | 5       | 5       | -<br>10 | -<br>20 | -<br>25 | -5      | 5   |
| 03041300 | 17 | 10.1N | 150.7E | 65  | 11 | 8  | 8  | 21  | 24  | 18  | 47  | 48  | 0       | -5      | -<br>10 | -<br>25 | -<br>35 | -<br>40 | -<br>20 | -20 |
| 03041306 | 18 | 10.2N | 149.8E | 65  | 0  | 24 | 36 | 37  | 24  | 29  | 76  | 160 | 0       | -5      | -<br>20 | -<br>35 | -<br>35 | -<br>30 | -5      | -20 |
| 03041312 | 19 | 10.2N | 149.0E | 75  | 8  | 30 | 32 | 26  | 13  | 25  | 132 | 170 | 0       | -<br>10 | -<br>20 | -<br>30 | -<br>25 | -<br>20 | 15      | -15 |
| 03041318 | 20 | 10.3N | 148.2E | 75  | 8  | 8  | 6  | 6   | 6   | 35  | 163 | 159 | 0       | -<br>20 | -<br>30 | -<br>30 | -<br>30 | -5      | 10      | -15 |
| 03041400 | 21 | 10.4N | 147.3E | 90  | 5  | 13 | 0  | 21  | 19  | 41  | 167 | 121 | 0       | -<br>15 | -<br>20 | -<br>15 | -<br>20 | 10      | 10      | 10  |
| 03041406 | 22 | 10.6N | 146.3E | 100 | 0  | 0  | 6  | 13  | 12  | 60  | 138 | 138 | 0       | -<br>15 | -<br>10 | -<br>10 | -<br>10 | 15      | 0       | 20  |
| 03041412 | 23 | 10.7N | 145.2E | 110 | 8  | 8  | 18 | 30  | 8   | 59  | 146 | 155 | 0       | 0       | 5       | 0       | 5       | 25      | 0       | 25  |
| 03041418 | 24 | 11.1N | 143.9E | 120 | 5  | 17 | 38 | 43  | 27  | 78  |     |     | 0       | 5       | 5       | 0       | 15      | 25      |         |     |
| 03041500 | 25 | 11.4N | 142.5E | 125 | 11 | 17 | 40 | 25  | 42  | 105 | 102 | 74  | 0       | 5       | 0       | 10      | 20      | 15      | 20      | 45  |
| 03041506 | 26 | 11.9N | 141.1E | 125 | 11 | 25 | 31 | 31  | 72  | 108 | 93  | 72  | 0       | 0       | 0       | 20      | 20      | 0       | 15      | 20  |
| 03041512 | 27 | 12.3N | 139.6E | 125 | 5  | 19 | 25 | 46  | 69  | 104 | 69  | 67  | 0       | -5      | 0       | 15      | 20      | -5      | 20      | 10  |
| 03041518 | 28 | 12.6N | 138.3E | 130 | 5  | 19 | 35 | 81  | 108 | 144 |     |     | 0       | -5      | 15      | 15      | 20      | 0       |         |     |
| 03041600 | 29 | 13.0N | 137.0E | 135 | 0  | 13 | 17 | 72  | 114 | 138 | 161 | 216 | 0       | 0       | 10      | 20      | 10      | 5       | 35      | 25  |
| 03041606 | 30 | 13.4N | 136.1E | 135 | 0  | 12 | 45 | 73  | 115 | 121 | 130 | 222 | 0       | 15      | 15      | 20      | 0       | 15      | 10      | -10 |
| 03041612 | 31 | 13.8N | 135.2E | 130 | 5  | 31 | 71 | 106 | 136 | 139 | 102 | 220 | 0       | 10      | 15      | 0       | -<br>15 | 10      | -5      | -10 |

| 03041618 | 32 | 14.0N | 134.4E | 115 | 5  | 48 | 80 | 107 | 139 | 125 | 138 | 288 | 0       | 0       | 0       | -<br>25 | -<br>45 | -<br>25 | -<br>45 | -20 |
|----------|----|-------|--------|-----|----|----|----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
| 03041700 | 33 | 14.0N | 133.6E | 115 | 0  | 36 | 57 | 81  | 105 | 94  | 89  | 222 | -<br>10 | 0       | -<br>15 | -<br>45 | -<br>50 | -<br>30 | -<br>35 | 0   |
| 03041706 | 34 | 13.7N | 132.8E | 110 | 11 | 24 | 59 | 69  | 72  | 70  | 96  | 120 | -5      | -5      | -<br>35 | -<br>45 | -<br>40 | -<br>40 | -<br>30 | 5   |
| 03041712 | 35 | 13.6N | 132.0E | 105 | 5  | 30 | 54 | 78  | 81  | 46  |     |     | 0       | -<br>15 | -<br>35 | -<br>35 | -<br>25 | -<br>45 |         |     |
| 03041718 | 36 | 13.5N | 131.2E | 105 | 6  | 26 | 47 | 64  | 61  | 61  | 206 | 276 | 0       | -<br>30 | -<br>30 | -<br>30 | -<br>25 | -<br>45 | -<br>30 | 5   |
| 03041800 | 37 | 13.5N | 130.6E | 115 | 8  | 26 | 41 | 35  | 18  | 67  | 166 | 218 | 0       | -<br>20 | -<br>20 | -<br>15 | -<br>20 | -<br>45 | -<br>10 | 15  |
| 03041806 | 38 | 13.5N | 130.0E | 125 | 6  | 18 | 38 | 35  | 36  | 74  | 170 | 195 | 0       | 5       | 10      | 10      | -5      | -<br>20 | 25      | 10  |
| 03041812 | 39 | 13.6N | 129.5E | 125 | 6  | 24 | 31 | 13  | 27  | 74  |     |     | 0       | 10      | 15      | 10      | -<br>20 | -<br>20 |         |     |
| 03041818 | 40 | 13.9N | 129.1E | 120 | 0  | 18 | 17 | 17  | 35  | 62  | 144 | 179 | 0       | 0       | 5       | -<br>20 | -<br>35 | -<br>25 | -5      | -5  |
| 03041900 | 41 | 14.2N | 128.7E | 115 | 8  | 6  | 18 | 34  | 70  | 96  | 143 | 214 | 0       | 5       | 0       | -<br>30 | -<br>40 | -5      | 0       | -10 |
| 03041906 | 42 | 14.7N | 128.3E | 105 | 0  | 0  | 17 | 38  | 54  | 87  | 123 | 331 | 0       | 0       | -<br>20 | -<br>35 | -<br>40 | -5      | 0       | -5  |
| 03041912 | 43 | 15.2N | 127.8E | 95  | 8  | 12 | 18 | 46  | 48  | 91  | 165 | 417 | 0       | 0       | -<br>30 | -<br>40 | -<br>35 | -5      | -5      | -10 |
| 03041918 | 44 | 15.7N | 127.3E | 90  | 5  | 13 | 21 | 32  | 62  | 80  | 178 | 537 | 0       | -<br>20 | -<br>35 | -<br>40 | -<br>30 | -<br>10 | -<br>10 | -15 |
| 03042000 | 45 | 16.2N | 126.6E | 85  | 11 | 8  | 32 | 48  | 57  | 74  | 198 | 677 | 0       | -<br>25 | -<br>35 | -<br>30 | -<br>10 | 0       | -<br>10 | -15 |
| 03042006 | 46 | 16.7N | 126.1E | 95  | 0  | 17 | 21 | 64  | 69  | 98  | 229 | 819 | 0       | -<br>15 | -<br>20 | -<br>15 | 0       | 5       | 5       | 5   |
| 03042012 | 47 | 17.2N | 125.6E | 100 | 6  | 25 | 54 | 67  | 115 | 123 | 309 | 991 | 0       | -5      | 0       | 20      | 15      | 10      | 5       | 0   |
| 03042018 | 48 | 17.9N | 125.1E | 100 | 5  | 26 | 6  | 13  | 36  | 51  | 298 |     | 0       | 5       | 15      | 25      | 15      | 10      | 0       |     |
| 03042100 | 49 | 18.4N | 124.6E | 100 | 6  | 31 | 26 | 64  | 50  | 91  | 463 |     | 0       | 5       | 25      | 25      | 20      | 10      | 0       |     |
| 03042106 | 50 | 18.7N | 124.3E | 95  | 0  | 41 | 43 | 62  | 54  | 152 | 723 |     |         | 10      | 25      | 15      | 20      | 5       | 5       |     |
| 03042112 | 51 | 19.2N | 124.4E | 85  | 11 | 6  | 38 | 17  | 30  | 182 | 835 |     | 0       | 20      | 15      | 15      | 10      | 0       | 0       |     |
| 03042118 | 52 | 19.7N | 124.0E | 75  | 8  | 43 | 59 | 90  | 94  | 69  |     |     | 0       | 10      | 10      | 10      | 5       | 0       |         |     |
| 03042200 | 53 | 19.9N | 123.5E | 55  | 16 | 39 | 37 | 57  | 78  | 240 |     |     | 0       | -5      | -5      | -<br>10 | -<br>10 | -<br>15 |         |     |
| 03042206 | 54 | 20.3N | 123.2E | 50  | 5  | 0  | 31 | 55  | 53  | 391 |     |     | 5       | 0       | 5       | 0       | -<br>10 | -<br>10 |         |     |
| 03042212 | 55 | 20.7N | 123.3E | 45  | 0  | 53 | 95 | 88  | 79  | 239 |     |     | 10      | 10      | 5       | 0       | -5      | -5      |         |     |
| 03042218 | 56 | 20.8N | 122.9E | 45  | 11 | 40 | 48 | 81  | 64  |     |     |     | -5      | 0       | -5      | -<br>10 | -<br>10 |         |         |     |
| 03042300 | 57 | 20.8N | 122.5E | 35  | 5  | 29 | 51 | 142 | 355 |     |     |     | 0       | -5      | -<br>10 | -<br>10 | -<br>15 |         |         |     |

| 03042306 | 58 | 20.9N | 122.4E  | 35 | 13 | 38 | 73  | 246 |    |    |     |     | 0  | -5 | -<br>10 | -<br>15 |    |    |    |    |
|----------|----|-------|---------|----|----|----|-----|-----|----|----|-----|-----|----|----|---------|---------|----|----|----|----|
| 03042312 | 59 | 21.1N | 122.4E  | 35 | 8  | 25 | 133 | 358 |    |    |     |     | 0  | -5 | -<br>10 | -<br>15 |    |    |    |    |
| 03042318 | 60 | 21.6N | 122.5E  | 35 | 11 | 50 | 229 | 540 |    |    |     |     | 0  | -5 | -<br>10 | -<br>10 |    |    |    |    |
| 03042400 | 61 | 22.1N | 122.8E  | 35 | 0  | 58 | 189 | 404 |    |    |     |     | 0  | 5  | 0       | 0       |    |    |    |    |
| 03042406 | 62 | 23.0N | 123.2E  | 35 | 5  | 89 | 231 |     |    |    |     |     | 0  | 0  | 0       |         |    |    |    |    |
| 03042412 | 63 | 24.8N | 124.0E  | 35 | 0  | 34 | 139 |     |    |    |     |     | 0  | 0  | 10      |         |    |    |    |    |
| 03042418 | 64 | 26.8N | 125.4E  | 35 | 0  | 55 |     |     |    |    |     |     | 0  | 5  |         |         |    |    |    |    |
| 03042500 | 65 | 29.0N | 127.3E  | 35 | 0  | 60 |     |     |    |    |     |     | 0  | 5  |         |         |    |    |    |    |
| 03042506 | 66 | 32.1N | 130.1E  | 30 | 11 |    |     |     |    |    |     |     | 0  |    |         |         |    |    |    |    |
| 03042512 |    | 34.2N | 134.0E  | 30 |    |    |     |     |    |    |     |     |    |    |         |         |    |    |    |    |
|          |    |       | AVERAGE |    | 8  | 28 | 50  | 73  | 64 | 96 | 184 | 250 | 1  | 7  | 12      | 16      | 17 | 16 | 17 | 19 |
|          |    |       | BIAS    |    |    |    |     |     |    |    |     |     | 0  | -1 | -3      | -6      | -7 | -8 | -7 | -9 |
|          |    |       | # CASES |    | 66 | 65 | 63  | 61  | 57 | 55 | 45  | 41  | 66 | 65 | 63      | 61      | 57 | 55 | 45 | 41 |

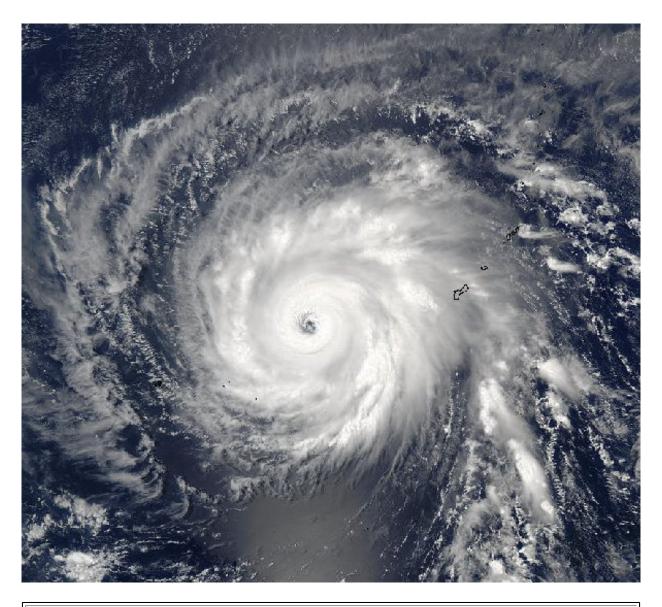


Figure 1-02W-3. 150350Z April 2003 MODIS true-color image of TY 02W (Kujira), located 180nm southwest of Guam, with an intensity of 125 knots.

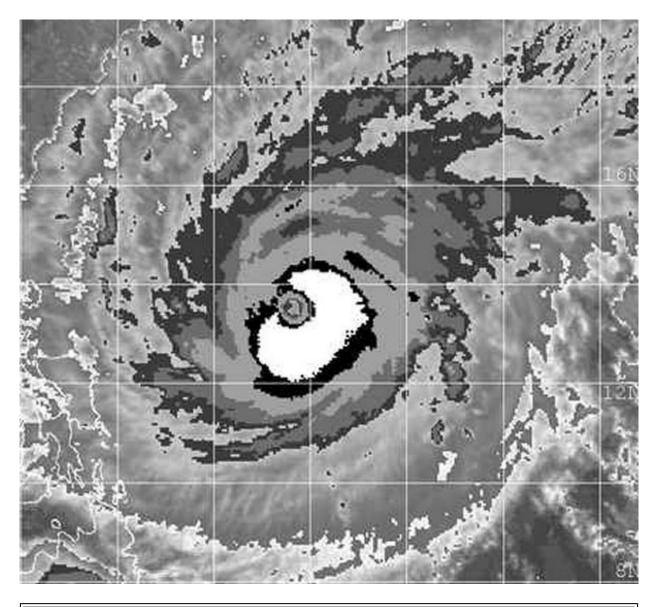
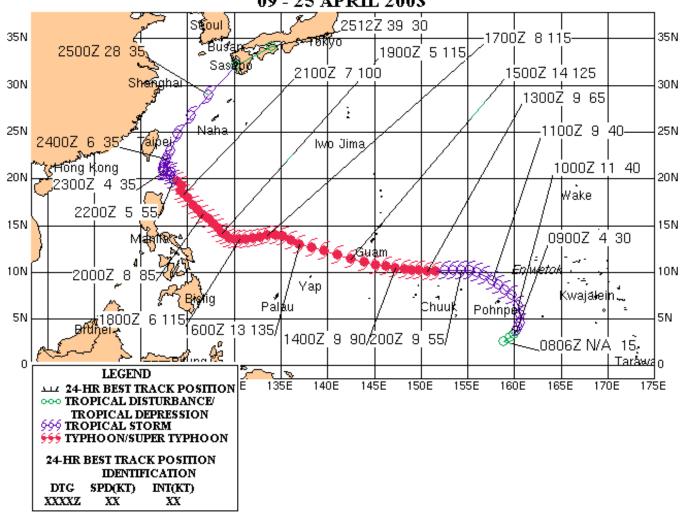
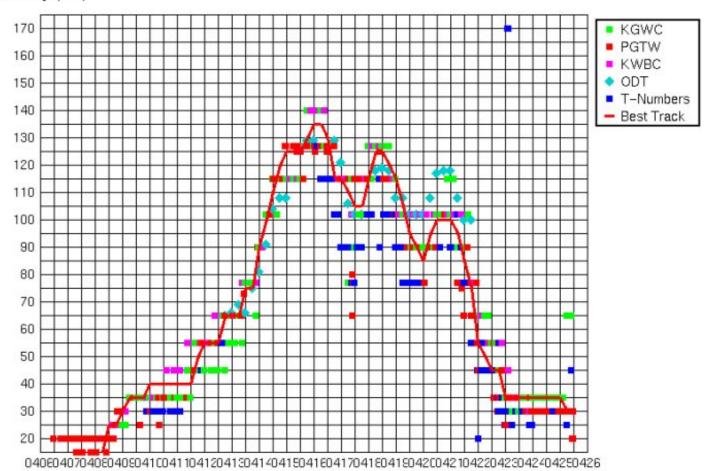


Figure 1-02W-1. 181049Z April 2003 GMS-5 enhanced infrared imagery of TY 02W (Kujira), located 480 nm east of the Luzon, with an peak intensity of 125 knots.

#### SUPER TYPHOON 02W (KUJIRA) 09 - 25 APRIL 2003



# Time Intensity for 02W



Fix Date (Zulu)

### **Tropical Depression (TD) 03W**



First Poor: 1730Z 16 May 03

First Fair: 0600Z 17 May 03

First TCFA: 1400Z 17 May 03

First Warning: 1800Z 17 May 03

Last Warning: 0600Z 20 May 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: NONE

Total Warnings: 11

Remarks:

1) Tropical Depression (TD) 03W was initially classified as a tropical disturbance in the Philippine Sea on 16 May, 2003. The first warning was issued at 1800Z on 17 May and the final warning was issued less than 72 hours later at 0600Z on 20 May. The cyclone was classified as a tropical storm in forecasts issued by JTWC but post analysis of satellite data indicates that this cyclone did not attain tropical storm intensity.

The cyclone initially meandered in the Philippine Sea then tracked generally poleward. The cyclone only attained a 30 knot intensity for approximately 48 hours before dissipating as a significant tropical cyclone due to marginal upper level synoptic flow patterns.

2) No reports of damage associated with this system were received.

#### Statistics for JTWC on TD03W

|          | WRN | BEST  | TRACK   |      | POS | SITIO | N ER | ROR | S   |    |    |     | WII | ND | ERF | ROF | RS |    |    |     |
|----------|-----|-------|---------|------|-----|-------|------|-----|-----|----|----|-----|-----|----|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00  | 12    | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03051700 |     | 7.3N  | 130.7E  | 25   |     |       |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051706 |     | 7.5N  | 130.7E  | 25   |     |       |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051712 |     | 7.7N  | 130.6E  | 25   |     |       |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051718 | 1   | 7.8N  | 130.4E  | 25   | 151 | 188   | 239  | 308 | 321 |    |    |     | 0   | 5  | 0   | -5  | -5 |    |    |     |
| 03051800 | 2   | 7.8N  | 130.2E  | 25   | 130 | 146   | 226  | 266 | 259 |    |    |     | 0   | 0  | 5   | 10  | 20 |    |    |     |
| 03051806 | 3   | 7.9N  | 130.0E  | 30   | 13  | 38    | 93   | 122 | 179 |    |    |     | 0   | 5  | 10  | 15  | 25 |    |    |     |
| 03051812 | 4   | 8.1N  | 130.0E  | 30   | 0   | 42    | 62   | 72  | 129 |    |    |     | 0   | 5  | 10  | 15  | 25 |    |    |     |
| 03051818 | 5   | 8.6N  | 130.4E  | 30   | 23  | 60    | 60   | 84  |     |    |    |     | 0   | 5  | 10  | 20  |    |    |    |     |
| 03051900 | 6   | 9.1N  | 130.9E  | 30   | 5   | 21    | 12   | 60  |     |    |    |     | 5   | 10 | 15  | 25  |    |    |    |     |
| 03051906 | 7   | 9.6N  | 131.2E  | 30   | 24  | 41    | 51   |     |     |    |    |     | 5   | 10 | 20  |     |    |    |    |     |
| 03051912 | 8   | 10.2N | 131.3E  | 30   | 82  | 118   | 137  |     |     |    |    |     | 0   | 5  | 15  |     |    |    |    |     |
| 03051918 | 9   | 10.8N | 131.1E  | 30   | 6   | 51    |      |     |     |    |    |     | 0   | 10 |     |     |    |    |    |     |
| 03052000 | 10  | 11.6N | 131.0E  | 30   | 13  | 27    |      |     |     |    |    |     | 0   | 5  |     |     |    |    |    |     |
| 03052006 | 11  | 12.6N | 130.8E  | 25   | 11  |       |      |     |     |    |    |     | 0   |    |     |     |    |    |    |     |
| 03052012 |     | 13.5N | 130.4E  | 25   |     |       |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 42  | 73    | 110  | 152 | 222 |    |    |     | 1   | 6  | 11  | 15  | 19 |    |    |     |
|          |     |       | BIAS    |      |     |       |      |     |     |    |    |     | 1   | 6  | 11  | 13  | 16 |    |    |     |
|          |     |       | # CASES |      | 11  | 10    | 8    | 6   | 4   |    |    |     | 11  | 10 | 8   | 6   | 4  |    |    |     |

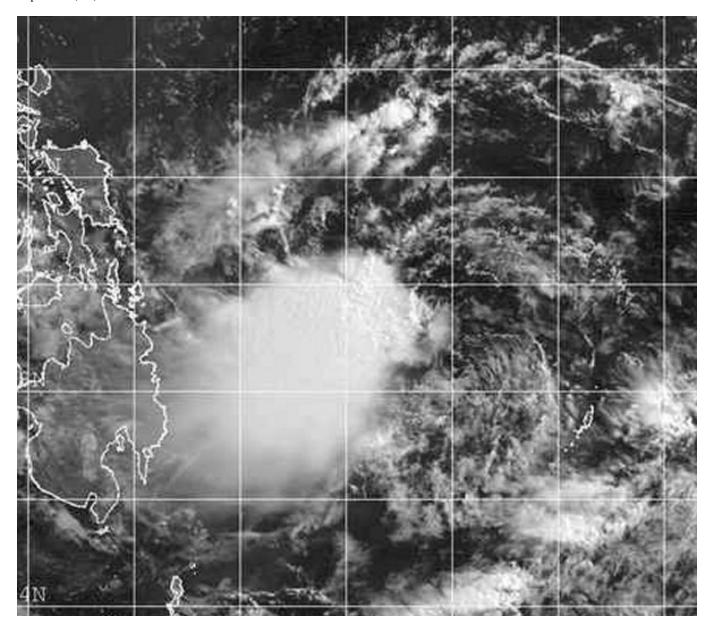
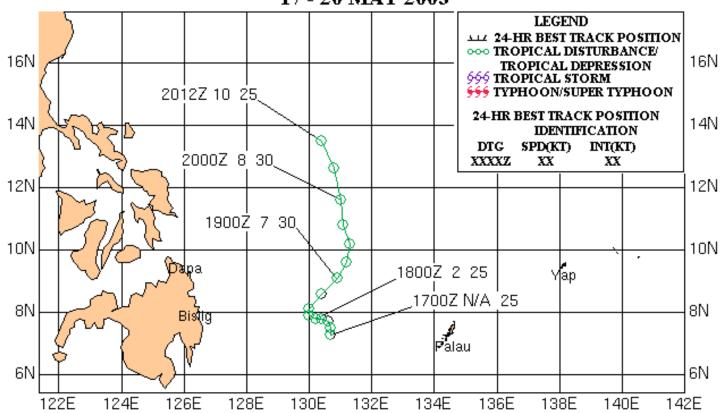
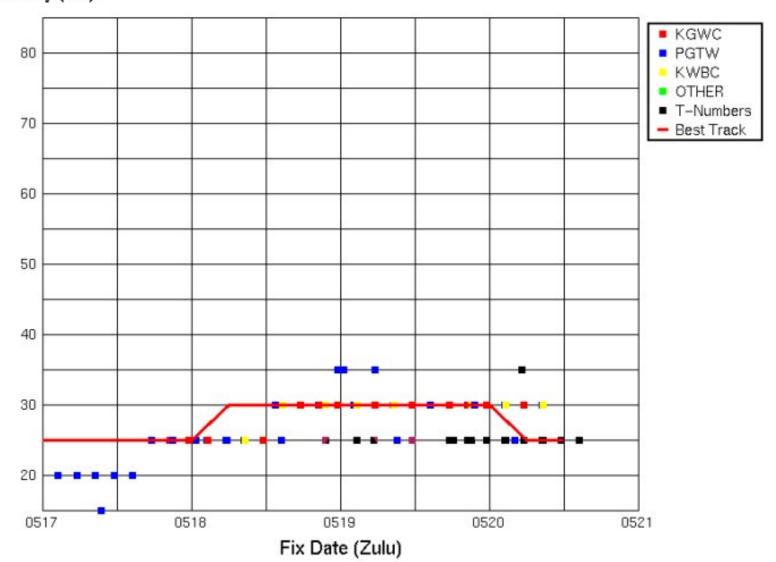


Figure 1-03W-1. 182331Z May 2003 GMS-5 visible image of TY 03W, located 290 nm east of the Davao, Philippines. The partially exposed low level circulation to the east of the deep convection had an estimated intensity of 35 knots.

#### TROPICAL DEPRESSION 03W 17 - 20 MAY 2003



# Time Intensity for 03W



### **Tropical Depression (TD) 03W**



First Poor: 1730Z 16 May 03

First Fair : 0600Z 17 May 03

First TCFA: 1400Z 17 May 03

First Warning: 1800Z 17 May 03

Last Warning: 0600Z 20 May 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: NONE

Total Warnings: 11

Remarks:

1) Tropical Depression (TD) 03W was initially classified as a tropical disturbance in the Philippine Sea on 16 May, 2003. The first warning was issued at 1800Z on 17 May and the final warning was issued less than 72 hours later at 0600Z on 20 May. The cyclone was classified as a tropical storm in forecasts issued by JTWC but post analysis of satellite data indicates that this cyclone did not attain tropical storm intensity.

The cyclone initially meandered in the Philippine Sea then tracked generally poleward. The cyclone only attained a 30 knot intensity for approximately 48 hours before dissipating as a significant tropical cyclone due to marginal upper level synoptic flow patterns.

2) No reports of damage associated with this system were received.

#### Statistics for JTWC on TD03W

|          | WRN | BEST  | TRACK   |      | POS | ITIO | N ER | ROF | RS  |    |    |     | WII | ND | ERI | ROF | RS |    |    |     |
|----------|-----|-------|---------|------|-----|------|------|-----|-----|----|----|-----|-----|----|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00  | 12   | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03051700 |     | 7.3N  | 130.7E  | 25   |     |      |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051706 |     | 7.5N  | 130.7E  | 25   |     |      |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051712 |     | 7.7N  | 130.6E  | 25   |     |      |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
| 03051718 | 1   | 7.8N  | 130.4E  | 25   | 151 | 188  | 239  | 308 | 321 |    |    |     | 0   | 5  | 0   | -5  | -5 |    |    |     |
| 03051800 | 2   | 7.8N  | 130.2E  | 25   | 130 | 146  | 226  | 266 | 259 |    |    |     | 0   | 0  | 5   | 10  | 20 |    |    |     |
| 03051806 | 3   | 7.9N  | 130.0E  | 30   | 13  | 38   | 93   | 122 | 179 |    |    |     | 0   | 5  | 10  | 15  | 25 |    |    |     |
| 03051812 | 4   | 8.1N  | 130.0E  | 30   | 0   | 42   | 62   | 72  | 129 |    |    |     | 0   | 5  | 10  | 15  | 25 |    |    |     |
| 03051818 | 5   | 8.6N  | 130.4E  | 30   | 23  | 60   | 60   | 84  |     |    |    |     | 0   | 5  | 10  | 20  |    |    |    |     |
| 03051900 | 6   | 9.1N  | 130.9E  | 30   | 5   | 21   | 12   | 60  |     |    |    |     | 5   | 10 | 15  | 25  |    |    |    |     |
| 03051906 | 7   | 9.6N  | 131.2E  | 30   | 24  | 41   | 51   |     |     |    |    |     | 5   | 10 | 20  |     |    |    |    |     |
| 03051912 | 8   | 10.2N | 131.3E  | 30   | 82  | 118  | 137  |     |     |    |    |     | 0   | 5  | 15  |     |    |    |    |     |
| 03051918 | 9   | 10.8N | 131.1E  | 30   | 6   | 51   |      |     |     |    |    |     | 0   | 10 |     |     |    |    |    |     |
| 03052000 | 10  | 11.6N | 131.0E  | 30   | 13  | 27   |      |     |     |    |    |     | 0   | 5  |     |     |    |    |    |     |
| 03052006 | 11  | 12.6N | 130.8E  | 25   | 11  |      |      |     |     |    |    |     | 0   |    |     |     |    |    |    |     |
| 03052012 |     | 13.5N | 130.4E  | 25   |     |      |      |     |     |    |    |     |     |    |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 42  | 73   | 110  | 152 | 222 |    |    |     | 1   | 6  | 11  | 15  | 19 |    |    |     |
|          |     |       | BIAS    |      |     |      |      |     |     |    |    |     | 1   | 6  | 11  | 13  | 16 |    |    |     |
|          |     |       | # CASES |      | 11  | 10   | 8    | 6   | 4   |    |    |     | 11  | 10 | 8   | 6   | 4  |    |    |     |

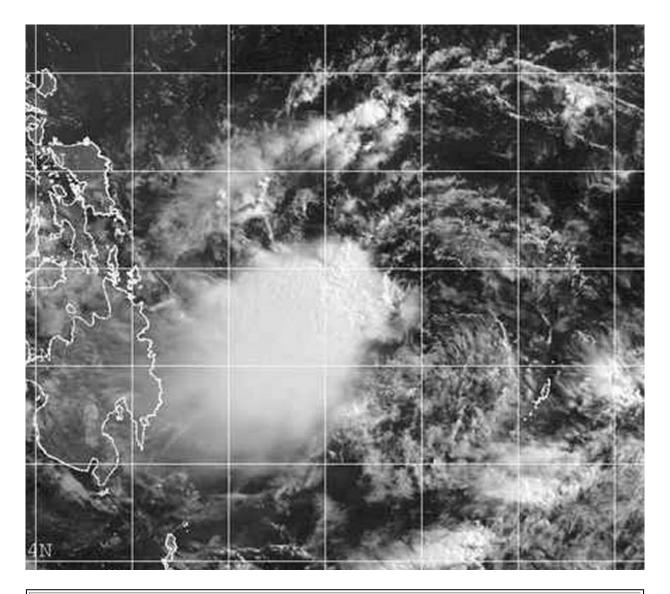
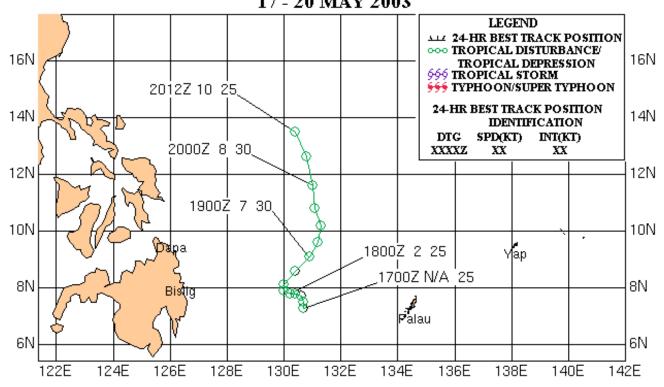
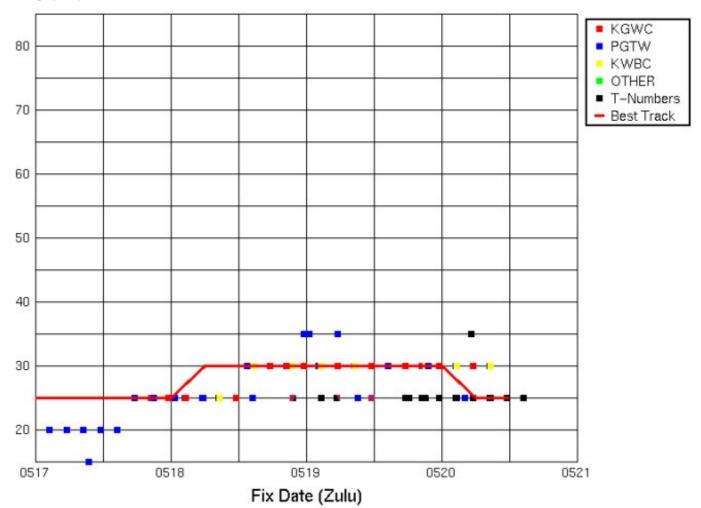


Figure 1-03W-1. 182331Z May 2003 GMS-5 visible image of TY 03W, located 290 nm east of the Davao, Philippines. The partially exposed low level circulation to the east of the deep convection had an estimated intensity of 35 knots.

#### TROPICAL DEPRESSION 03W 17 - 20 MAY 2003



# Time Intensity for 03W



## Typhoon (TY) 04W (Chan-Hom)\*



First Poor : 0600Z 18 May 03

First Fair: 1000Z 18May 03

First TCFA: 1500Z 18May 03

First Warning: 0000Z 19 May 03

Last Warning: 0000Z 27 May 03

Max Intensity: 115 kts, gusts to 140 kts

Landfall: NONE

Total Warnings: 33

Remarks:

1) Typhoon (TY) 04W was initially detected as persistent deep convection over a broad low level circulation center (LLCC) and reached warning criteria within 18 hours, at 0000Z on 19 May. An Air Force weather reconnaissance flight was flown into this cyclone just after the first warning was issued while the cyclone was still broad and difficult to locate with satellite fixes. This flight provided center fix and wind information with 40 knot winds near the center on a 30 second average.

TY 04W tracked poleward towards a weakness in the low to mid-level steering ridge by a migratory shortwave trough. Intensification for this cyclone was very close to one Dvorak T-number/day from the initial warning until approximately 1800Z on 23 May, when TY 04W reached maximum intensity. Maximum intensity was maintained for 30 hours as the system passed the ridge axis moved more north-northeastward while accelerating.

After 0000Z on 25 May, TY 04W began to decrease in intensity rapidly as it increased track speed towards a shortwave trough to the northeast. Dry air entrainment was noted by 0600Z on 26 May in microwave satellite imagery as the cyclone began extratropical transition. TY 04W completed extratropical transition by 0000Z on 27 May, at which time a final warning was issued.

2) FEMA damage assessments indicated Chuuk sustained some damage to homes and food crops due to heavy rain as TY 04W passed near the island. Storm intensity was approximately 35 to 45 knots, with Chuuk experiencing winds of 35 to 38 knots as the system moved northwest of the island.

### \*Named by WMO designated RSMC

|          |     |       |        | Stati | isti | cs fo | or J1 | ΓWC | on  | TY0 | 4W  |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|-------|-------|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     | 1     |        |       |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |     |       | TRACK  |       |      |       | ON E  |     |     |     |     |     |    | ND      |         |         |         |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00   | 12    | 24    | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03051800 |     | 4.0N  | 147.9E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051806 |     | 4.6N  | 148.2E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051812 |     | 5.2N  | 148.6E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051818 |     | 5.8N  | 149.0E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051900 | 1   | 6.3N  | 149.3E | 25    | 26   | 88    | 147   | 132 | 112 | 160 | 197 | 290 | 0  | -5      | 5       | 5       | 0       | 0       | -<br>30 | -50 |
| 03051906 | 2   | 6.7N  | 149.8E | 35    | 8    | 49    | 27    | 30  | 27  | 128 | 231 | 313 | 0  | 10      | 20      | 5       | 15      | 15      | -5      | -20 |
| 03051912 | 3   | 6.8N  | 150.4E | 35    | 26   | 38    | 6     | 13  | 58  | 179 | 251 | 394 | 0  | 10      | 10      | 5       | 15      | 10      | -<br>20 | -25 |
| 03051918 | 4   | 6.9N  | 150.8E | 35    | 66   | 61    | 66    | 104 | 160 | 257 | 338 | 516 | 0  | 10      | 0       | 10      | 15      | 25      | -<br>40 | -25 |
| 03052000 | 5   | 7.3N  | 151.0E | 35    | 0    | 8     | 19    | 86  | 132 | 249 | 336 | 512 | 0  | 5       | 5       | 15      | 15      | 5       | -<br>35 | -25 |
| 03052006 | 6   | 7.7N  | 150.8E | 35    | 18   | 18    | 19    | 80  | 118 | 185 | 282 | 495 | 0  | -<br>10 | 0       | 5       | 10      | -<br>15 | -<br>40 | 0   |
| 03052012 | 7   | 8.0N  | 150.6E | 45    | 5    | 0     | 69    | 119 | 164 | 242 | 322 | 573 | 10 | 10      | 20      | 25      | 35      | 10      | 0       | 10  |
| 03052018 | 8   | 8.4N  | 150.4E | 55    | 26   | 71    | 133   | 179 | 218 | 288 | 474 | 765 | 0  | 10      | 20      | 30      | 50      | 10      | 0       | 60  |
| 03052100 | 9   | 8.8N  | 150.3E | 55    | 11   | 93    | 143   | 182 | 212 | 299 | 520 | 794 | 0  | 15      | 25      | 45      | 35      | 10      | 5       | 60  |
| 03052106 | 10  | 9.4N  | 150.6E | 55    | 21   | 76    | 110   | 144 | 166 | 287 | 516 | 816 | 0  | 10      | 25      | 40      | 20      | 0       | 25      | 60  |
| 03052112 | 11  | 10.3N | 150.9E | 55    | 23   | 30    | 54    | 84  | 141 | 247 | 489 | 722 | 0  | 0       | 15      | 10      | 10      | -<br>10 | 15      | 50  |
| 03052118 | 12  | 11.1N | 151.0E | 60    | 5    | 18    | 37    | 64  | 126 | 260 | 453 | 729 | 0  | 10      | 20      | 10      | -5      | -<br>10 | 45      | 60  |
| 03052200 | 13  | 11.8N | 151.1E | 65    | 5    | 35    | 65    | 114 | 163 | 289 | 486 | 830 | 0  | 10      | 5       | 0       | 0       | -<br>10 | 50      | 60  |
| 03052206 | 14  | 12.6N | 151.2E | 65    | 8    | 21    | 55    | 98  | 133 | 249 | 523 | 931 | 0  | 10      | -<br>10 | -<br>20 | -<br>15 | 10      | 35      | 30  |
| 03052212 | 15  | 13.3N | 151.3E | 65    | 8    | 21    | 64    | 103 | 148 | 298 | 462 |     | 0  | -<br>10 | -<br>20 | -<br>25 | -<br>20 | 0       | 20      |     |

|          |    |       |         |     | ,  |     |     | ,   |     |     |     |     |    |         |         |         |         |    |    |    |
|----------|----|-------|---------|-----|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|----|----|----|
| 03052218 | 16 | 14.2N | 151.3E  | 65  | 0  | 17  | 46  | 64  | 129 | 239 | 411 |     | 5  | 30      | -<br>45 | -<br>40 | -<br>30 | 20 | 40 |    |
| 03052300 | 17 | 14.9N | 151.2E  | 85  | 0  | 48  | 57  | 79  | 144 | 273 |     |     | 0  | -<br>15 | -<br>15 | -<br>15 | -<br>25 | 20 |    |    |
| 03052306 | 18 | 15.6N | 151.2E  | 95  | 0  | 44  | 74  | 112 | 172 | 244 |     |     | 0  | -5      | 5       | -5      | 10      | 35 |    |    |
| 03052312 | 19 | 16.4N | 151.4E  | 105 | 0  | 13  | 46  | 111 | 174 | 296 |     |     | 0  | 0       | 0       | -5      | 10      | 30 |    |    |
| 03052318 | 20 | 17.3N | 151.5E  | 115 | 8  | 27  | 50  | 57  | 69  | 197 |     |     | 0  | 10      | 5       | 10      | 20      | 15 |    |    |
| 03052400 | 21 | 18.2N | 151.6E  | 115 | 0  | 21  | 65  | 85  | 127 | 283 |     |     | 0  | -<br>10 | -<br>15 | -<br>10 | -5      | 15 |    |    |
| 03052406 | 22 | 19.1N | 152.1E  | 115 | 17 | 53  | 49  | 79  | 166 |     |     |     | 0  | -<br>15 | -5      | 5       | 0       |    |    |    |
| 03052412 | 23 | 20.0N | 152.6E  | 115 | 8  | 39  | 44  | 60  | 188 |     |     |     | 0  | -<br>15 | -5      | 5       | 0       |    |    |    |
| 03052418 | 24 | 21.0N | 153.8E  | 115 | 6  | 20  | 32  | 16  | 44  |     |     |     | 0  | 5       | 15      | 10      | 10      |    |    |    |
| 03052500 | 25 | 22.4N | 154.7E  | 115 | 5  | 16  | 41  | 27  | 46  |     |     |     | 0  | 0       | 10      | 5       | 10      |    |    |    |
| 03052506 | 26 | 23.8N | 155.6E  | 90  | 13 | 32  | 21  | 78  | 57  |     |     |     | 0  | 10      | 10      | 10      | 0       |    |    |    |
| 03052512 | 27 | 25.2N | 156.6E  | 90  | 0  | 27  | 66  | 91  |     |     |     |     | 0  | 5       | 0       | 10      |         |    |    |    |
| 03052518 | 28 | 26.8N | 157.5E  | 65  | 8  | 25  | 78  | 47  |     |     |     |     | 0  | -5      | 10      | 10      |         |    |    |    |
| 03052600 | 29 | 28.3N | 158.6E  | 65  | 5  | 53  | 90  |     |     |     |     |     | 0  | 0       | 10      |         |         |    |    |    |
| 03052606 | 30 | 29.7N | 160.4E  | 55  | 7  | 5   | 121 |     |     |     |     |     | 0  | 5       | 5       |         |         |    |    |    |
| 03052612 | 31 | 31.0N | 162.3E  | 55  | 31 | 134 |     |     |     |     |     |     | 0  | 5       |         |         |         |    |    |    |
| 03052618 | 32 | 32.4N | 164.5E  | 45  | 28 | 209 |     |     |     |     |     |     | 0  | -5      |         |         |         |    |    |    |
| 03052700 | 33 | 33.9N | 166.9E  | 45  | 11 |     |     |     |     |     |     |     | 0  |         |         |         |         |    |    |    |
| 03052706 |    | 36.1N | 170.9E  | 45  |    |     |     |     |     |     |     |     |    |         |         |         |         |    |    |    |
|          |    |       | AVERAGE |     | 13 | 44  | 63  | 87  | 131 | 245 | 393 | 620 | 0  | 9       | 12      | 14      | 15      | 13 | 25 | 38 |
|          |    |       | BIAS    |     |    |     |     |     |     |     |     |     | 0  | 1       | 4       | 5       | 7       | 9  | 4  | 18 |
|          |    |       | # CASES |     | 33 | 32  | 30  | 28  | 26  | 21  | 16  | 14  | 33 | 32      | 30      | 28      | 26      | 21 | 16 | 14 |

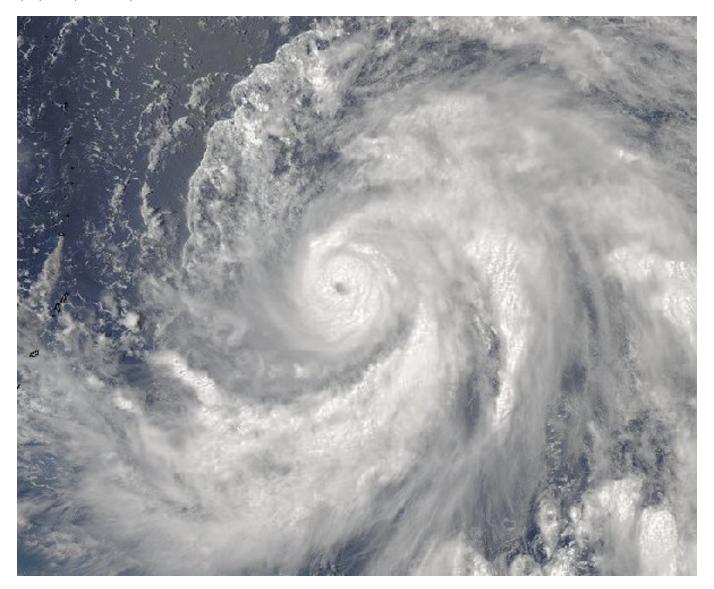


Figure 1-04W-1. 230315Z May 2003 MODIS true-color image of TY 04W (Chan-Hom), located 390nm east-northeast of Guam, with an intensity of 85 knots.

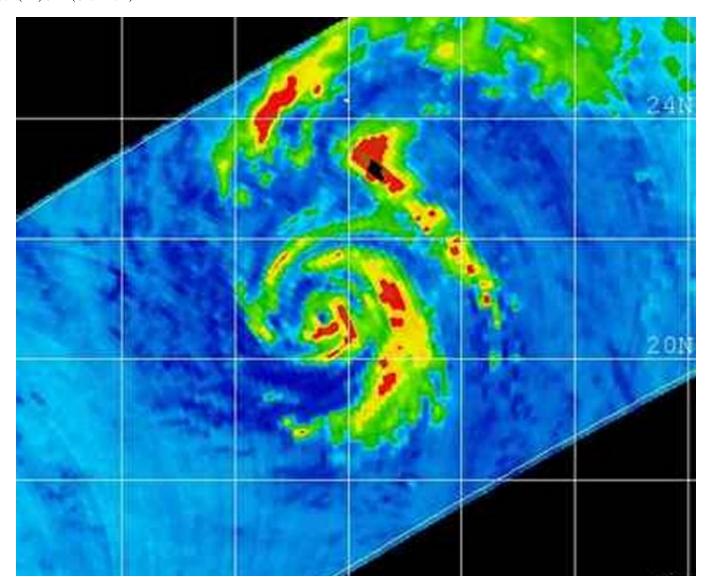
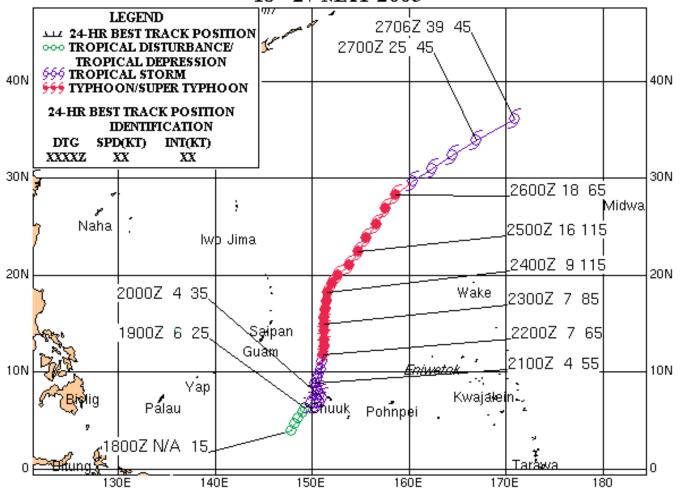


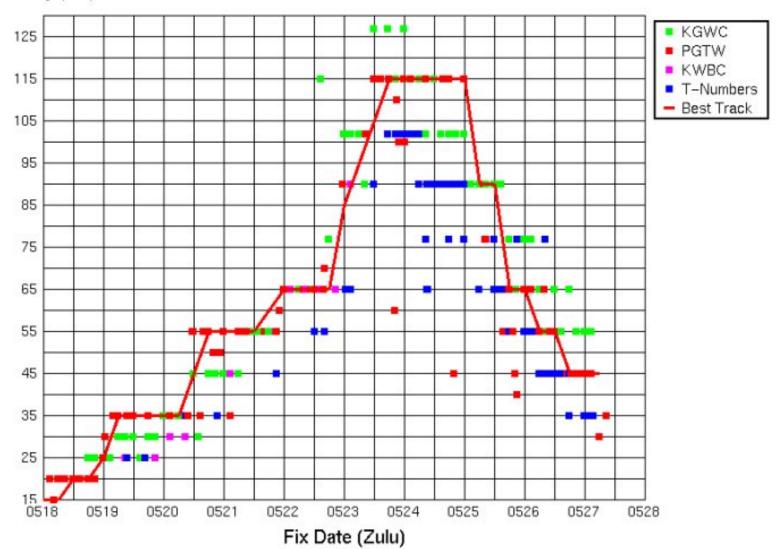
Figure 1-04W-2. 241519Z May 2003 85 GHz TRMM image of TY 04W (Chan-hom), the eye was located 560 nm northeast of the Saipan, with a peak intensity of 115 knots.

### TYPHOON 04W (CHAN-HOM)





## Time Intensity for 04W



### Typhoon (TY) 04W (Chan-Hom)\*



First Poor : 0600Z 18 May 03

First Fair : 1000Z 18May 03

First TCFA: 1500Z 18May 03

First Warning: 0000Z 19 May 03

Last Warning: 0000Z 27 May 03

Max Intensity: 115 kts, gusts to 140 kts

Landfall: NONE

Total Warnings: 33

Remarks:

1) Typhoon (TY) 04W was initially detected as persistent deep convection over a broad low level circulation center (LLCC) and reached warning criteria within 18 hours, at 0000Z on 19 May. An Air Force weather reconnaissance flight was flown into this cyclone just after the first warning was issued while the cyclone was still broad and difficult to locate with satellite fixes. This flight provided center fix and wind information with 40 knot winds near the center on a 30 second average.

TY 04W tracked provided poleward towards a weakness in the low to mid-level steering ridge by a migratory shortwave trough. Intensification for this cyclone was very close to one Dvorak T-number/day from the initial warning until approximately 1800Z on 23 May, when TY 04W reached maximum intensity. Subsequently, maximum intensity was maintained for 30 hours as the system passed the ridge axis moved more north-northeastward while accelerating.

After 0000Z on 25 May, TY 04W began to decrease in intensity rapidly as it increased track speed towards a shortwave trough to the northeast. Dry air entrainment was noted by 0600Z on 26 May in microwave satellite imagery as the cyclone began extratropical transition. TY 04W completed extratropical transition by 0000Z on 27 May, at which time a final warning was issued.

2) FEMA damage assessments indicated Chuuk sustained some damage to homes and food crops due to heavy rain as TY 04W passed near the island. Storm intensity was approximately 35 to 45 knots, with Chuuk experiencing winds of 35 to 38 knots as the system moved northwest of the island.

\*Named by WMO designated RSMC

|          |     |       |        | Stati | isti | cs fo | or JT | ſWC | on  | TY0 | 4W  |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|-------|-------|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |       |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |     | BEST  | TRACK  |       |      |       | ON E  |     | DRS |     |     |     |    |         | ERF     |         |         |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00   | 12    | 24    | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03051800 |     | 4.0N  | 147.9E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051806 |     | 4.6N  | 148.2E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051812 |     | 5.2N  | 148.6E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051818 |     | 5.8N  | 149.0E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03051900 | 1   | 6.3N  | 149.3E | 25    | 26   | 88    | 147   | 132 | 112 | 160 | 197 | 290 | 0  | -5      | 5       | 5       | 0       | 0       | -<br>30 | -50 |
| 03051906 | 2   | 6.7N  | 149.8E | 35    | 8    | 49    | 27    | 30  | 27  | 128 | 231 | 313 | 0  | 10      | 20      | 5       | 15      | 15      | -5      | -20 |
| 03051912 | 3   | 6.8N  | 150.4E | 35    | 26   | 38    | 6     | 13  | 58  | 179 | 251 | 394 | 0  | 10      | 10      | 5       | 15      | 10      | -<br>20 | -25 |
| 03051918 | 4   | 6.9N  | 150.8E | 35    | 66   | 61    | 66    | 104 | 160 | 257 | 338 | 516 | 0  | 10      | 0       | 10      | 15      | 25      | -<br>40 | -25 |
| 03052000 | 5   | 7.3N  | 151.0E | 35    | 0    | 8     | 19    | 86  | 132 | 249 | 336 | 512 | 0  | 5       | 5       | 15      | 15      | 5       | -<br>35 | -25 |
| 03052006 | 6   | 7.7N  | 150.8E | 35    | 18   | 18    | 19    | 80  | 118 | 185 | 282 | 495 | 0  | -<br>10 | 0       | 5       | 10      | -<br>15 | -<br>40 | 0   |
| 03052012 | 7   | 8.0N  | 150.6E | 45    | 5    | 0     | 69    | 119 | 164 | 242 | 322 | 573 | 10 | 10      | 20      | 25      | 35      | 10      | 0       | 10  |
| 03052018 | 8   | 8.4N  | 150.4E | 55    | 26   | 71    | 133   | 179 | 218 | 288 | 474 | 765 | 0  | 10      | 20      | 30      | 50      | 10      | 0       | 60  |
| 03052100 | 9   | 8.8N  | 150.3E | 55    | 11   | 93    | 143   | 182 | 212 | 299 | 520 | 794 | 0  | 15      | 25      | 45      | 35      | 10      | 5       | 60  |
| 03052106 | 10  | 9.4N  | 150.6E | 55    | 21   | 76    | 110   | 144 | 166 | 287 | 516 | 816 | 0  | 10      | 25      | 40      | 20      | 0       | 25      | 60  |
| 03052112 | 11  | 10.3N | 150.9E | 55    | 23   | 30    | 54    | 84  | 141 | 247 | 489 | 722 | 0  | 0       | 15      | 10      | 10      | -<br>10 | 15      | 50  |
| 03052118 | 12  | 11.1N | 151.0E | 60    | 5    | 18    | 37    | 64  | 126 | 260 | 453 | 729 | 0  | 10      | 20      | 10      | -5      | -<br>10 | 45      | 60  |
| 03052200 | 13  | 11.8N | 151.1E | 65    | 5    | 35    | 65    | 114 | 163 | 289 | 486 | 830 | 0  | 10      | 5       | 0       | 0       | -<br>10 | 50      | 60  |
| 03052206 | 14  | 12.6N | 151.2E | 65    | 8    | 21    | 55    | 98  | 133 | 249 | 523 | 931 | 0  | 10      | -<br>10 | -<br>20 | -<br>15 | 10      | 35      | 30  |
| 03052212 | 15  | 13.3N | 151.3E | 65    | 8    | 21    | 64    | 103 | 148 | 298 | 462 |     | 0  | -<br>10 | -<br>20 | -<br>25 | -<br>20 | 0       | 20      |     |
| 03052218 | 16  | 14.2N | 151.3E | 65    | 0    | 17    | 46    | 64  | 129 | 239 | 411 |     | 5  | -<br>30 | -<br>45 | -<br>40 | -<br>30 | 20      | 40      |     |
| 03052300 | 17  | 14.9N | 151.2E | 85    | 0    | 48    | 57    | 79  | 144 | 273 |     |     | 0  | -       | -<br>15 | -       | -       | 20      |         |     |
| 03052306 | 18  | 15.6N | 151.2E | 95    | 0    | 44    | 74    | 112 | 172 | 244 |     |     | 0  |         | 5       | -5      | 10      | 35      |         |     |
| 03052312 | 19  |       | 151.4E | 105   | 0    | 13    | 46    |     |     | 296 |     |     | 0  | 0       | 0       | -5      | 10      |         |         |     |

| 03052318 | 20 | 17.3N | 151.5E  | 115 | 8  | 27  | 50  | 57 | 69  | 197 |     |     | 0  | 10      | 5       | 10      | 20 | 15 |    |    |
|----------|----|-------|---------|-----|----|-----|-----|----|-----|-----|-----|-----|----|---------|---------|---------|----|----|----|----|
| 03052400 | 21 | 18.2N | 151.6E  | 115 | 0  | 21  | 65  | 85 | 127 | 283 |     |     | 0  | -<br>10 | -<br>15 | -<br>10 | -5 | 15 |    |    |
| 03052406 | 22 | 19.1N | 152.1E  | 115 | 17 | 53  | 49  | 79 | 166 |     |     |     | 0  | -<br>15 | -5      | 5       | 0  |    |    |    |
| 03052412 | 23 | 20.0N | 152.6E  | 115 | 8  | 39  | 44  | 60 | 188 |     |     |     | 0  | -<br>15 | -5      | 5       | 0  |    |    |    |
| 03052418 | 24 | 21.0N | 153.8E  | 115 | 6  | 20  | 32  | 16 | 44  |     |     |     | 0  | 5       | 15      | 10      | 10 |    |    |    |
| 03052500 | 25 | 22.4N | 154.7E  | 115 | 5  | 16  | 41  | 27 | 46  |     |     |     | 0  | 0       | 10      | 5       | 10 |    |    |    |
| 03052506 | 26 | 23.8N | 155.6E  | 90  | 13 | 32  | 21  | 78 | 57  |     |     |     | 0  | 10      | 10      | 10      | 0  |    |    |    |
| 03052512 | 27 | 25.2N | 156.6E  | 90  | 0  | 27  | 66  | 91 |     |     |     |     | 0  | 5       | 0       | 10      |    |    |    |    |
| 03052518 | 28 | 26.8N | 157.5E  | 65  | 8  | 25  | 78  | 47 |     |     |     |     | 0  | -5      | 10      | 10      |    |    |    |    |
| 03052600 | 29 | 28.3N | 158.6E  | 65  | 5  | 53  | 90  |    |     |     |     |     | 0  | 0       | 10      |         |    |    |    |    |
| 03052606 | 30 | 29.7N | 160.4E  | 55  | 7  | 5   | 121 |    |     |     |     |     | 0  | 5       | 5       |         |    |    |    |    |
| 03052612 | 31 | 31.0N | 162.3E  | 55  | 31 | 134 |     |    |     |     |     |     | 0  | 5       |         |         |    |    |    |    |
| 03052618 | 32 | 32.4N | 164.5E  | 45  | 28 | 209 |     |    |     |     |     |     | 0  | -5      |         |         |    |    |    |    |
| 03052700 | 33 | 33.9N | 166.9E  | 45  | 11 |     |     |    |     |     |     |     | 0  |         |         |         |    |    |    |    |
| 03052706 |    | 36.1N | 170.9E  | 45  |    |     |     |    |     |     |     |     |    |         |         |         |    |    |    |    |
|          |    |       | AVERAGE |     | 13 | 44  | 63  | 87 | 131 | 245 | 393 | 620 | 0  | 9       | 12      | 14      | 15 | 13 | 25 | 38 |
|          |    |       | BIAS    |     |    |     |     |    |     |     |     |     | 0  | 1       | 4       | 5       | 7  | 9  | 4  | 18 |
|          |    |       | # CASES |     | 33 | 32  | 30  | 28 | 26  | 21  | 16  | 14  | 33 | 32      | 30      | 28      | 26 | 21 | 16 | 14 |

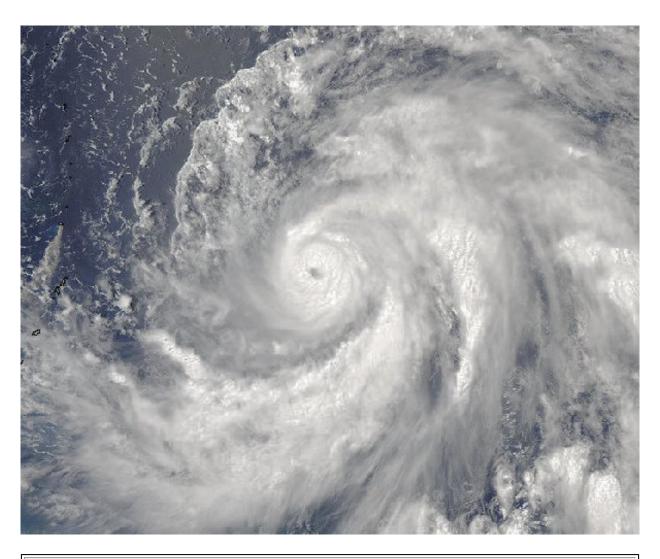


Figure 1-04W-1. 230315Z May 2003 MODIS true-color image of TY 04W (Chan-Hom), located 390nm east-northeast of Guam, with an intensity of 85 knots.

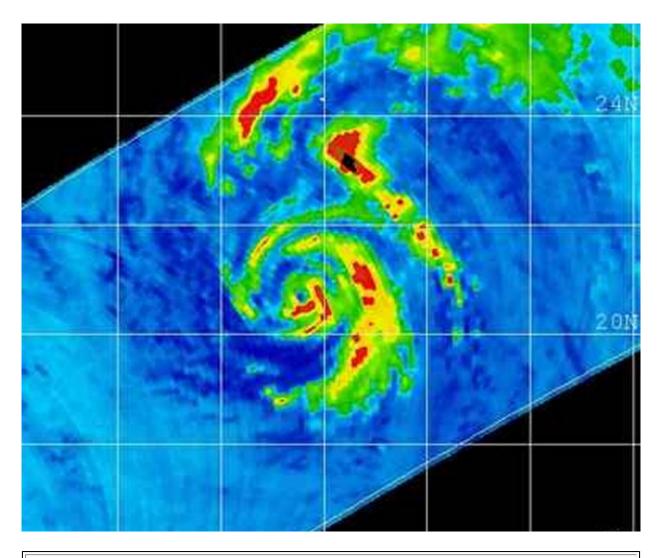
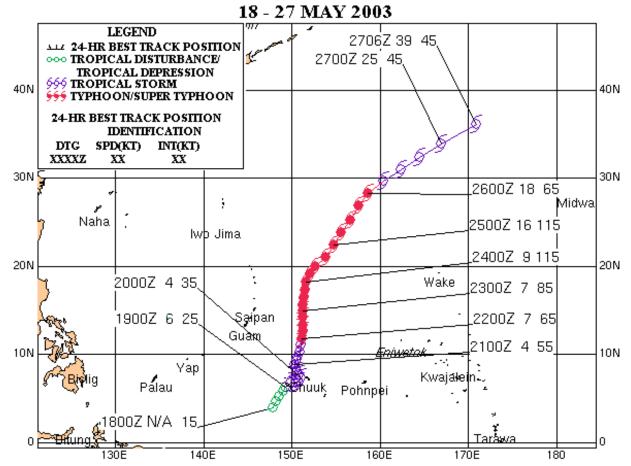
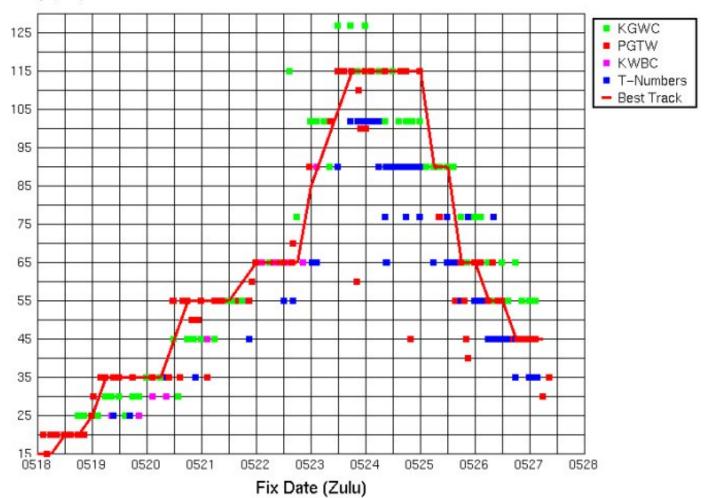


Figure 1-04W-2. 241519Z May 2003 85 GHz TRMM image of TY 04W (Chan-hom), the eye was located 560 nm northeast of the Saipan, with a peak intensity of 115 knots.

### TYPHOON 04W (CHAN-HOM)



# Time Intensity for 04W



### Tropical Storm (TS) 05W (Linfa)\*



First Poor : 1900Z 23 May 03

First Fair: 0600Z 24 May 03

First TCFA: 1900Z 24 May 03

First Warning: 0000Z 25 May 03

Last Warning: 1800Z 30 May 03

Max Intensity: 60 kts, gusts to 75 kts

Landfall: Near Dagupan, Philippines

Total Warnings: 24

Remarks:

1) Tropical Storm (TS) 05W formed west of Luzon, Philippines and intensified slowly as it looped counter-clockwise in the South China Sea. Subsequently, the cyclone began to move east, toward Luzon island, in response to westerly steering flow.

The cyclone made landfall near Dagupan, Philippines, weakened due to land effects and then moved east into the Philippine Sea. After moving back over water, the cyclone began to move north-northeast with most of the heavy convection stripped from the cyclone. Subsequently, the cyclone began to slowly intensify reaching maximum intensity of 55 knots as it tracked north, along the eastern periphery of the Ryuku Islands.

Of note, one U. S. Air Force weather reconnaissance mission with a WC-130 aircraft was flown into this cyclone and an aircraft fix was made at 0446Z on 30 May 2003. Data from this mission supported available radar and satellite data for the same period.

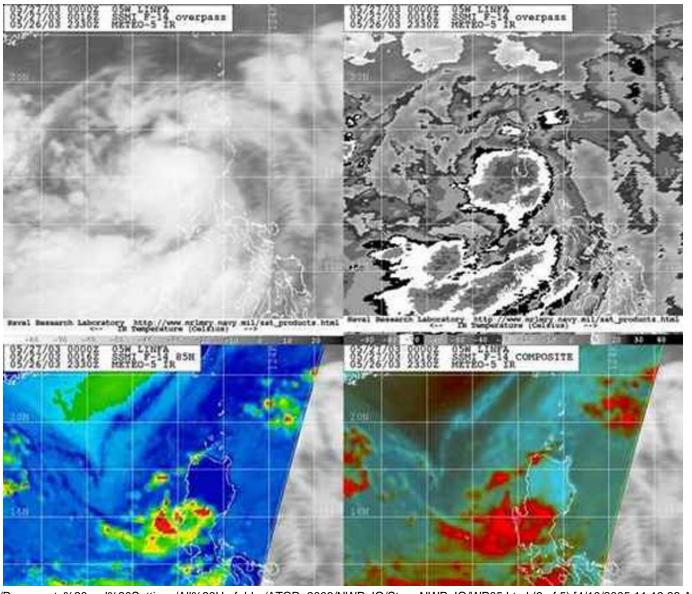
After 0000Z on the 30th, extratropical influences began to affect this cyclone and transition for an extratropical cyclone occurred shortly after 1800Z on 30 May in the Bungo Strait region between Kyushu and Shikoku.

2) No damage reports were received associated with this system.

\*Named by WMO designated RSMC

|          |     |       |        | Statis | stics | for   | JTV  | /C o | n TS | 3 <b>0</b> 5 | W   |     |         |         |         |         |         |         |         |     |
|----------|-----|-------|--------|--------|-------|-------|------|------|------|--------------|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |        |       |       |      |      |      |              |     |     |         |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |        | POS   | SITIO | N EF | RROI | RS   |              |     |     | WII     | ND      | ER      | RO      | RS      |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind   | 00    | 12    | 24   | 36   | 48   | 72           | 96  | 120 | 00      | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03052406 |     | 15.5N | 118.7E | 20     |       |       |      |      |      |              |     |     |         |         |         |         |         |         |         |     |
| 03052412 |     | 16.0N | 118.8E | 20     |       |       |      |      |      |              |     |     |         |         |         |         |         |         |         |     |
| 03052418 |     | 16.3N | 118.8E | 20     |       |       |      |      |      |              |     |     |         |         |         |         |         |         |         |     |
| 03052500 | 1   | 16.5N | 118.6E | 25     | 0     | 29    | 57   | 30   | 29   | 187          |     |     | 0       | 0       | -<br>10 | 0       | -5      | -<br>10 |         |     |
| 03052506 | 2   | 16.5N | 118.3E | 30     | 8     | 18    | 6    | 19   | 62   | 185          |     |     | 0       | -5      | 5       | 0       | 0       | -<br>10 |         |     |
| 03052512 | 3   | 16.4N | 118.1E | 30     | 8     | 8     | 12   | 24   | 24   | 187          |     |     | 0       | -5      | 0       | -<br>10 | -<br>10 | 5       |         |     |
| 03052518 | 4   | 16.1N | 118.1E | 45     | 18    | 6     | 8    | 25   | 71   | 181          | 238 | 420 | 0       | 5       | 10      | 10      | -5      | 10      | -<br>25 | -10 |
| 03052600 | 5   | 16.0N | 118.4E | 45     | 13    | 31    | 50   | 107  | 179  | 292          | 251 |     | 0       | 10      | 10      | 25      | 0       | 10      | -<br>25 |     |
| 03052606 | 6   | 16.1N | 118.7E | 45     | 11    | 26    | 70   | 145  | 200  | 346          | 619 |     | 0       | 0       | 20      | 5       | -5      | 0       | -<br>25 |     |
| 03052612 | 7   | 16.1N | 119.0E | 45     | 8     | 6     | 58   | 119  | 194  | 268          | 482 |     | 0       | 0       | -5      | -5      | 5       | 0       | 0       |     |
| 03052618 | 8   | 16.1N | 119.4E | 55     | 0     | 34    | 91   | 141  | 210  | 316          | 566 |     | 0       | 0       | 0       | 5       | 20      | 10      | 30      |     |
| 03052700 | 9   | 16.1N | 119.8E | 55     | 0     | 59    | 97   | 172  | 244  | 345          |     |     | 0       | 10      | 10      | 25      | 35      | 30      |         |     |
| 03052706 | 10  | 16.1N | 120.8E | 45     | 17    | 48    | 98   | 178  | 235  | 368          |     |     | 0       | 0       | 10      | 20      | 25      | 20      |         |     |
| 03052712 | 11  | 16.3N | 121.8E | 35     | 8     | 37    | 131  | 206  | 251  | 405          |     |     | 0       | 10      | 15      | 20      | 20      | 20      |         |     |
| 03052800 | 12  | 17.4N | 123.7E | 30     | 62    | 142   | 209  | 230  | 281  |              |     |     | -5      | 0       | 0       | 0       | 0       |         |         |     |
| 03052806 | 13  | 18.8N | 124.0E | 30     | 85    | 122   | 156  | 160  | 169  |              |     |     | -5      | 0       | 0       | -<br>10 | 0       |         |         |     |
| 03052812 | 14  | 19.7N | 125.0E | 30     | 101   | 175   | 203  | 234  | 266  |              |     |     | -5      | -5      | -<br>10 | -<br>15 | -<br>15 |         |         |     |
| 03052818 | 15  | 20.8N | 125.6E | 30     | 161   | 167   | 187  | 254  | 331  |              |     |     | -5      | 0       | -<br>15 | -<br>15 | -<br>15 |         |         |     |
| 03052900 | 16  | 21.8N | 126.3E | 35     | 40    | 73    | 80   | 21   |      |              |     |     | -<br>10 | -<br>10 | -<br>15 | -<br>25 |         |         |         |     |
| 03052906 | 17  | 22.6N | 127.2E | 35     | 12    | 57    | 51   | 19   |      |              |     |     | 0       | -<br>10 | -<br>10 | -5      |         |         |         |     |

| 03052912 | 18 | 23.4N | 128.1E  | 45 | 18 | 36 | 22 |     |     |     |     |     | -5 | -<br>10 | -<br>10 |    |    |    |    |     |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|----|----|----|----|-----|
| 03052918 | 19 | 24.4N | 129.3E  | 55 | 6  | 20 | 54 |     |     |     |     |     | 0  | 0       | 0       |    |    |    |    |     |
| 03053000 | 20 | 25.8N | 130.1E  | 55 | 13 | 48 |    |     |     |     |     |     | 0  | 0       |         |    |    |    |    |     |
| 03053006 | 21 | 27.8N | 131.0E  | 55 | 28 | 68 |    |     |     |     |     |     | 5  | 10      |         |    |    |    |    |     |
| 03053012 | 22 | 29.9N | 131.6E  | 55 | 16 |    |    |     |     |     |     |     | 0  |         |         |    |    |    |    |     |
| 03053018 | 23 | 32.0N | 132.0E  | 50 | 0  |    |    |     |     |     |     |     | 0  |         |         |    |    |    |    |     |
|          |    |       | AVERAGE |    | 28 | 58 | 86 | 123 | 183 | 280 | 431 | 420 | 2  | 4       | 8       | 11 | 11 | 11 | 21 | 10  |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | -1 | 0       | 0       | 1  | 3  | 8  | -9 | -10 |
|          |    |       | # CASES |    | 23 | 21 | 19 | 17  | 15  | 11  | 5   | 1   | 23 | 21      | 19      | 17 | 15 | 11 | 5  | 1   |



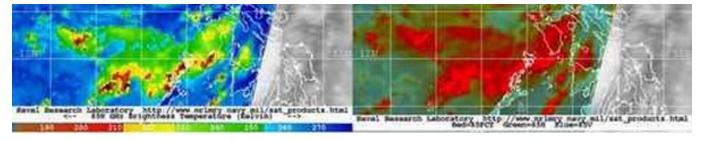
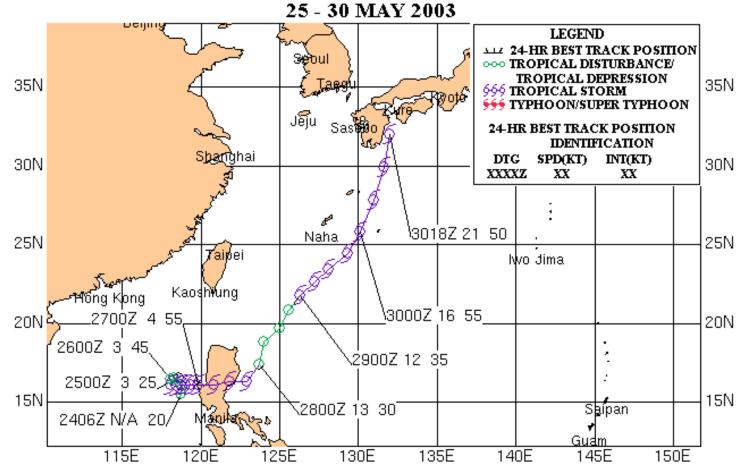
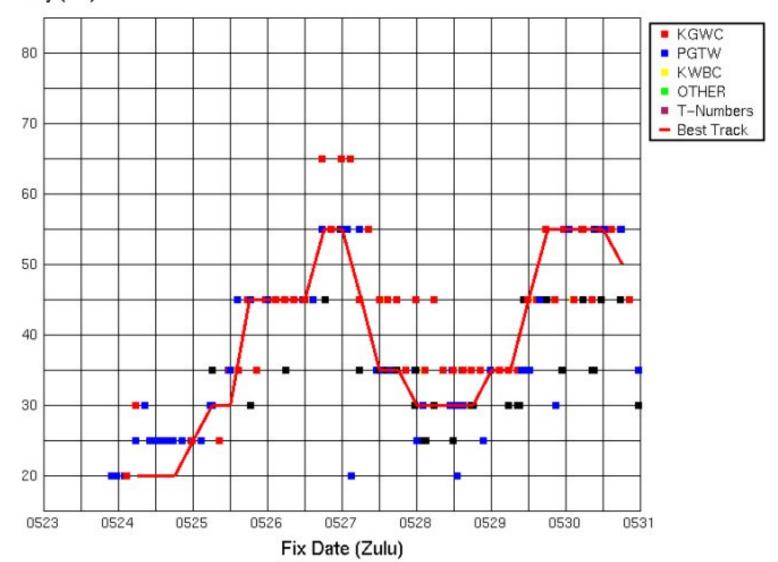


Figure 1-05W-1. 270016Z May 2003 multi-sensor satellite images of TY 05W (Linfa), located along the west coast of Luzon, with a peak intensity of 55 knots.

## TROPICAL STORM 05W (LINFA)



# Time Intensity for 05W



### **Tropical Storm (TS) 05W (Linfa)**



First Poor: 1900Z 23 May 03

First Fair : 0600Z 24 May 03

First TCFA: 1900Z 24 May 03

First Warning: 0000Z 25 May 03

Last Warning: 1800Z 30 May 03

Max Intensity: 60 kts, gusts to 75 kts

Landfall: Near Dagupan, Philippines

Total Warnings: 24

Remarks:

1) Tropical Storm (TS) 05W formed west of Luzon, Philippines and intensified slowly as it looped counter-clockwise in the South China Sea. Subsequently, the cyclone began to move east, toward Luzon island, in apparent response to westerly steering flow.

The cyclone made landfall near Dagupan, Philippines, weakened due to land effects and then moved east into the Philippine Sea. After moving back over water, the cyclone began to move north-northeast with most of the heavy convection stripped from the cyclone. Subsequently, the cyclone began to slowly intensify reaching maximum intensity of 55 knots as it tracked north, along the eastern periphery of the Ryuku Islands.

Of note, one U. S. Air Force weather reconnaissance mission with a WC-130 aircraft was flown into this cyclone and an aircraft fix was made at 0446Z on 30 May 2003. Data from this mission supported available radar and satellite data for the same period.

After 0000Z on the 30th, extratropical influences began to affect this cyclone and transition for an extratropical cyclone occurred shortly after 1800Z on 30 May in the Bungo Strait region between Kyushu and Shikoku.

2) No damage reports were received associated with this system.

#### Statistics for JTWC on TS 05W

|          | WRN | BEST  | ΓRACK  |      | POS | SITIC | N EF | RROI | RS  |     |     |     | WI      | ND      | ER      | RO      | RS      |         |         |     |
|----------|-----|-------|--------|------|-----|-------|------|------|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT   | LONG   | wind | 00  | 12    | 24   | 36   | 48  | 72  | 96  | 120 | 00      | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03052406 |     | 15.5N | 118.7E | 20   |     |       |      |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03052412 |     | 16.0N | 118.8E | 20   |     |       |      |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03052418 |     | 16.3N | 118.8E | 20   |     |       |      |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03052500 | 1   | 16.5N | 118.6E | 25   | 0   | 29    | 57   | 30   | 29  | 187 |     |     | 0       | 0       | -<br>10 | 0       | -5      | -<br>10 |         |     |
| 03052506 | 2   | 16.5N | 118.3E | 30   | 8   | 18    | 6    | 19   | 62  | 185 |     |     | 0       | -5      | 5       | 0       | 0       | -<br>10 |         |     |
| 03052512 | 3   | 16.4N | 118.1E | 30   | 8   | 8     | 12   | 24   | 24  | 187 |     |     | 0       | -5      | 0       | -<br>10 | -<br>10 | 5       |         |     |
| 03052518 | 4   | 16.1N | 118.1E | 45   | 18  | 6     | 8    | 25   | 71  | 181 | 238 | 420 | 0       | 5       | 10      | 10      | -5      | 10      | -<br>25 | -10 |
| 03052600 | 5   | 16.0N | 118.4E | 45   | 13  | 31    | 50   | 107  | 179 | 292 | 251 |     | 0       | 10      | 10      | 25      | 0       | 10      | -<br>25 |     |
| 03052606 | 6   | 16.1N | 118.7E | 45   | 11  | 26    | 70   | 145  | 200 | 346 | 619 |     | 0       | 0       | 20      | 5       | -5      | 0       | -<br>25 |     |
| 03052612 | 7   | 16.1N | 119.0E | 45   | 8   | 6     | 58   | 119  | 194 | 268 | 482 |     | 0       | 0       | -5      | -5      | 5       | 0       | 0       |     |
| 03052618 | 8   | 16.1N | 119.4E | 55   | 0   | 34    | 91   | 141  | 210 | 316 | 566 |     | 0       | 0       | 0       | 5       | 20      | 10      | 30      |     |
| 03052700 | 9   | 16.1N | 119.8E | 55   | 0   | 59    | 97   | 172  | 244 | 345 |     |     | 0       | 10      | 10      | 25      | 35      | 30      |         |     |
| 03052706 | 10  | 16.1N | 120.8E | 45   | 17  | 48    | 98   | 178  | 235 | 368 |     |     | 0       | 0       | 10      | 20      | 25      | 20      |         |     |
| 03052712 | 11  | 16.3N | 121.8E | 35   | 8   | 37    | 131  | 206  | 251 | 405 |     |     | 0       | 10      | 15      | 20      | 20      | 20      |         |     |
| 03052800 | 12  | 17.4N | 123.7E | 30   | 62  | 142   | 209  | 230  | 281 |     |     |     | -5      | 0       | 0       | 0       | 0       |         |         |     |
| 03052806 | 13  | 18.8N | 124.0E | 30   | 85  | 122   | 156  | 160  | 169 |     |     |     | -5      | 0       | 0       | -<br>10 | 0       |         |         |     |
| 03052812 | 14  | 19.7N | 125.0E | 30   | 101 | 175   | 203  | 234  | 266 |     |     |     | -5      | -5      | -<br>10 | -<br>15 | -<br>15 |         |         |     |
| 03052818 | 15  | 20.8N | 125.6E | 30   | 161 | 167   | 187  | 254  | 331 |     |     |     | -5      | 0       | -<br>15 | -<br>15 | -<br>15 |         |         |     |
| 03052900 | 16  | 21.8N | 126.3E | 35   | 40  | 73    | 80   | 21   |     |     |     |     | -<br>10 | -<br>10 | -<br>15 | -<br>25 |         |         |         |     |
| 03052906 | 17  | 22.6N | 127.2E | 35   | 12  | 57    | 51   | 19   |     |     |     |     | 0       | -<br>10 | -<br>10 | -5      |         |         |         |     |
| 03052912 | 18  | 23.4N | 128.1E | 45   | 18  | 36    | 22   |      |     |     |     |     | -5      | -<br>10 | -<br>10 |         |         |         |         |     |
| 03052918 | 19  | 24.4N | 129.3E | 55   | 6   | 20    | 54   |      |     |     |     |     | 0       | 0       | 0       |         |         |         |         |     |
| 03053000 | 20  | 25.8N | 130.1E | 55   | 13  | 48    |      |      |     |     |     |     | 0       | 0       |         |         |         |         |         |     |
| 03053006 | 21  | 27.8N | 131.0E | 55   | 28  | 68    |      |      |     |     |     |     | 5       | 10      |         |         |         |         |         |     |
| 03053012 | 22  | 29.9N | 131.6E | 55   | 16  |       |      |      |     |     |     |     | 0       |         |         |         |         |         |         |     |
| 03053018 | 23  | 32.0N | 132.0E | 50   | 0   |       |      |      |     |     |     |     | 0       |         |         |         |         |         |         |     |

|  | AVERAGE | 28 | 58 | 86 | 123 | 183 | 280 | 431 | 420 | 2  | 4  | 8  | 11 | 11 | 11 | 21 | 10  |
|--|---------|----|----|----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|-----|
|  | BIAS    |    |    |    |     |     |     |     |     | -1 | 0  | 0  | 1  | 3  | 8  | -9 | -10 |
|  | # CASES | 23 | 21 | 19 | 17  | 15  | 11  | 5   | 1   | 23 | 21 | 19 | 17 | 15 | 11 | 5  | 1   |

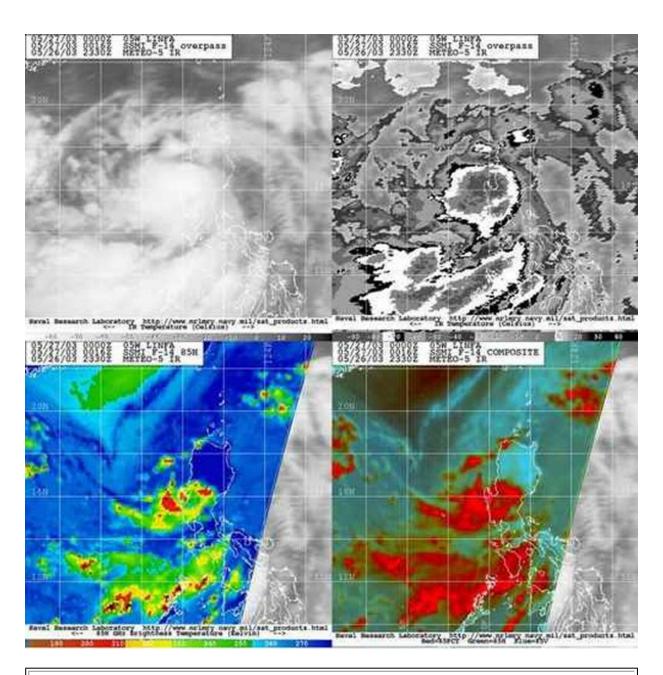
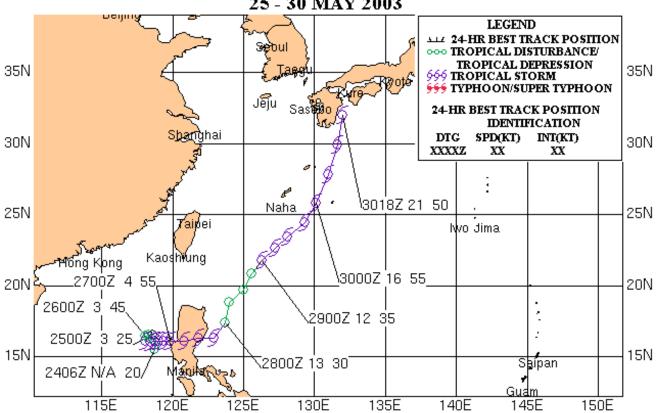
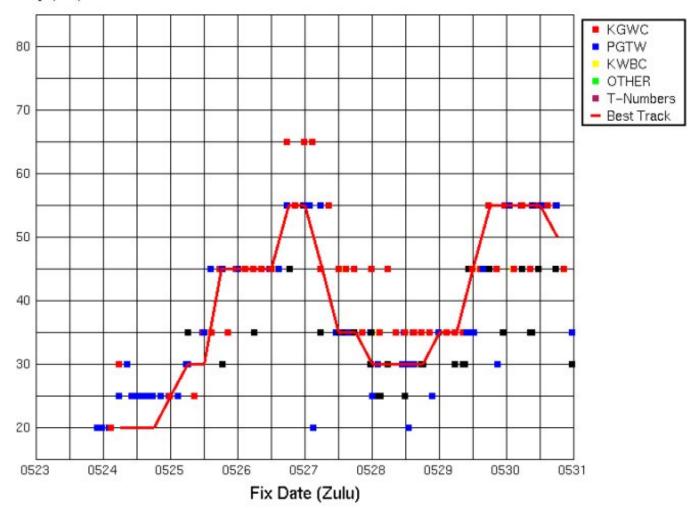


Figure 1-05W-1. 270016Z May 2003 multi-sensor satellite images of TY 05W (Linfa), located along the west coast of Luzon, with a peak intensity of 55 knots.

#### TROPICAL STORM 05W (LINFA) 25 - 30 MAY 2003



# Time Intensity for 05W



### Tropical Storm (TS) 06W (Nangka)\*



First Poor: 2200Z 29 May 03

First Fair: 0130Z 31 May 03

First TCFA: 0500Z 31 May 03

First Warning: 1200Z 31 May 03

Last Warning: 0000Z 03 Jun 03, Extratropical

Max Intensity: 40 kts, gusts to 50 kts

Landfall: NA

Total Warnings: 11

Remarks:

1) Tropical Storm (TS) 06W was initially detected as a tropical disturbance in the South China Sea on 29 May, 2003. The first warning was issued at 1200Z on 31 May. Moderate vertical wind shear was present throughout the life of the cyclone, resulting in an intensification rate lower than a Dvorak T-number/day.

TS 06W reached a maximum intensity of 45 knots during northeast movement through the Luzon Strait and passage east of Taiwan. After approximately 1800Z on 02 May, the cyclone encountered increased vertical wind shear associated with the mid-latitude westerly winds, weakened to tropical depression strength and transitioned to an extratropical cyclone after 03 June at 0000Z.

2) Available reports indicate no casualties or damage were associated with this cyclone.

\*Named by WMO designated RSMC

|          |        |        | S       | Statis | tics | s fo | r JT | WC  | on T | S 06 | SW |     |           |          |    |     |    |    |    |     |
|----------|--------|--------|---------|--------|------|------|------|-----|------|------|----|-----|-----------|----------|----|-----|----|----|----|-----|
|          | MANDAL | DEGT   |         |        | D0   | OIT  | 101  |     | 000  |      |    |     | \ A / I N | <u> </u> |    | 000 |    |    |    |     |
|          |        | BEST 1 |         |        | _    | _    | ION  |     |      |      |    |     |           |          |    | OR  | _  |    |    |     |
| DTG      | NO.    | LAT    | LONG    | wind   | 00   | 12   | 24   | 36  | 48   | 72   | 96 | 120 | 00        | 12       | 24 | 36  | 48 | 72 | 96 | 120 |
| 03053100 |        | 17.1N  | 117.2E  | 15     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
| 03053106 |        | 17.1N  | 117.1E  | 25     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
| 03053112 | 1      | 17.2N  | 117.0E  | 25     | 37   | 59   | 88   | 113 | 203  | 621  |    |     | 0         | 0        | -5 | -10 | 0  | 20 |    |     |
| 03053118 | 2      | 17.4N  | 117.0E  | 30     | 16   | 52   | 133  | 239 | 315  | 668  |    |     | 0         | 0        | -5 | 0   | 0  | 25 |    |     |
| 03060100 | 3      | 17.6N  | 117.2E  | 30     | 12   | 75   | 153  | 234 | 265  | 644  |    |     | 0         | -5       | -5 | 0   | 10 | 20 |    |     |
| 03060106 | 4      | 17.9N  | 117.5E  | 35     | 24   | 88   | 187  | 260 | 428  |      |    |     | 0         | -5       | 0  | 5   | 20 |    |    |     |
| 03060112 | 5      | 18.5N  | 118.2E  | 40     | 49   | 91   | 133  | 205 | 403  |      |    |     | -5        | -5       | 0  | 10  | 25 |    |    |     |
| 03060118 | 6      | 19.2N  | 118.9E  | 45     | 22   | 46   | 81   | 144 | 270  |      |    |     | -5        | 5        | 10 | 20  | 25 |    |    |     |
| 03060200 | 7      | 20.0N  | 119.6E  | 45     | 23   | 66   | 101  | 217 | 283  |      |    |     | 0         | 5        | 15 | 20  | 25 |    |    |     |
| 03060206 | 8      | 20.8N  | 120.8E  | 45     | 46   | 80   | 172  | 312 |      |      |    |     | 5         | 10       | 20 | 25  |    |    |    |     |
| 03060212 | 9      | 21.5N  | 122.0E  | 45     | 30   | 56   | 88   | 200 |      |      |    |     | 5         | 10       | 15 | 15  |    |    |    |     |
| 03060218 | 10     | 22.2N  | 123.3E  | 45     | 16   | 78   | 185  |     |      |      |    |     | -15       | -5       | 5  |     |    |    |    |     |
| 03060300 | 11     | 23.0N  | 125.3E  | 40     | 5    | 66   | 154  |     |      |      |    |     | -10       | 0        | 0  |     |    |    |    |     |
| 03060306 |        | 24.1N  | 127.9E  | 35     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
| 03060312 |        | 25.6N  | 130.9E  | 30     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
| 03060318 |        | 27.4N  | 133.8E  | 25     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
| 03060400 |        | 29.4N  | 136.8E  | 25     |      |      |      |     |      |      |    |     |           |          |    |     |    |    |    |     |
|          |        |        | AVERAGE |        | 26   | 69   | 134  | 214 | 309  | 645  |    |     | 4         | 5        | 7  | 12  | 15 | 22 |    |     |
|          |        |        | BIAS    |        |      |      |      |     |      |      |    |     | -2        | 1        | 5  | 9   | 15 | 22 |    |     |
|          |        |        | # CASES |        | 11   | 11   | 11   | 9   | 7    | 3    |    |     | 11        | 11       | 11 | 9   | 7  | 3  |    |     |

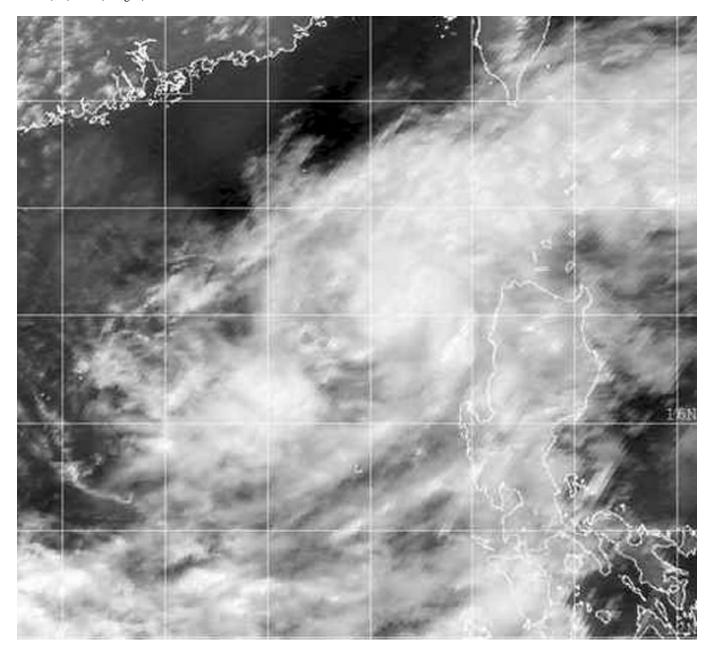
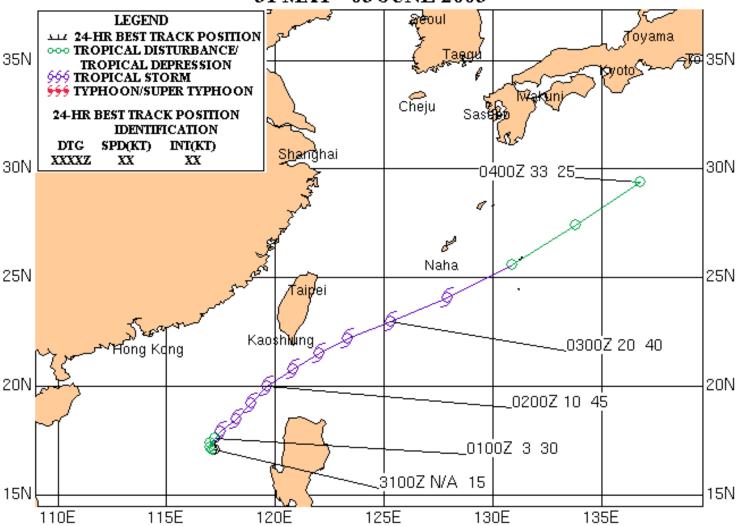
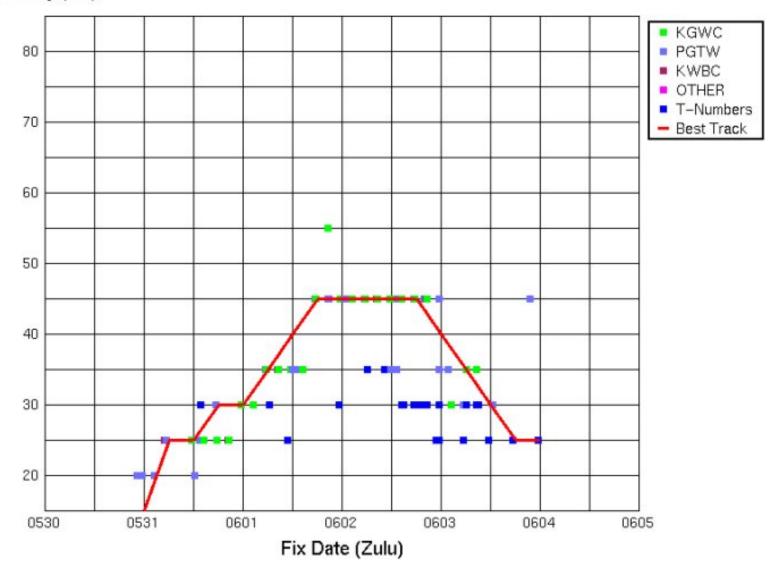


Figure 1-06W-1. 010630Z June 2003 Goes-9 visible imagery of TS 06W (Nangka), located in the south china sea northwest of Luzon with an estimated intensity of 35 knots.

#### TROPICAL STORM 06W (NANGKA) 31 MAY - 03 JUNE 2003



# Time Intensity for 06W



### **Tropical Storm (TS) 06W (Nangka)**



First Poor : 2200Z 29 May 03

First Fair: 0130Z 31 May 03

First TCFA: 0500Z 31 May 03

First Warning: 1200Z 31 May 03

Last Warning: 0000Z 03 Jun 03, Extratropical

Max Intensity: 40 kts, gusts to 50 kts

Landfall: NA

Total Warnings: 11

Remarks:

1) Tropical Storm (TS) 06W was initially detected as a tropical disturbance in the South China Sea on 29 May, 2003 and, approximately 36 hours later, the first warning was issued at 1200Z on 31 May. Moderate vertical wind shear was present throughout the life of the cyclone, resulting in an intensification rate lower than a Dvorak T-number/day.

TS 06W reached a maximum intensity of 45 knots during northeast movement through the Luzon Strait and passage east of Taiwan. After approximately 1800Z on 02 May, the cyclone encountered increased vertical winds shear associated with the mid-latitude westerly winds, weakened to tropical depression strength and transitioned to an extratropical cyclone after 03 June at 0000Z.

2) Available reports indicate no casualties or damage were associated with this cyclone.

\*Named by WMO designated RSMC

|          |     |        | 5      | Statis | tics | s fo | r JT | WC  | on T | S 06 | SW |     |     |      |     |     |    |    |    |     |
|----------|-----|--------|--------|--------|------|------|------|-----|------|------|----|-----|-----|------|-----|-----|----|----|----|-----|
|          |     |        |        |        |      |      |      |     |      |      |    |     |     |      |     |     |    |    |    |     |
|          | WRN | BEST T | ΓRACK  |        | PC   | SIT  | ION  | ERR | ORS  |      |    |     | WIN | ND E | ERR | ORS | 3  |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00   | 12   | 24   | 36  | 48   | 72   | 96 | 120 | 00  | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 03053100 |     | 17.1N  | 117.2E | 15     |      |      |      |     |      |      |    |     |     |      |     |     |    |    |    |     |
| 03053106 |     | 17.1N  | 117.1E | 25     |      |      |      |     |      |      |    |     |     |      |     |     |    |    |    |     |
| 03053112 | 1   | 17.2N  | 117.0E | 25     | 37   | 59   | 88   | 113 | 203  | 621  |    |     | 0   | 0    | -5  | -10 | 0  | 20 |    |     |
| 03053118 | 2   | 17.4N  | 117.0E | 30     | 16   | 52   | 133  | 239 | 315  | 668  |    |     | 0   | 0    | -5  | 0   | 0  | 25 |    |     |
| 03060100 | 3   | 17.6N  | 117.2E | 30     | 12   | 75   | 153  | 234 | 265  | 644  |    |     | 0   | -5   | -5  | 0   | 10 | 20 |    |     |
| 03060106 | 4   | 17.9N  | 117.5E | 35     | 24   | 88   | 187  | 260 | 428  |      |    |     | 0   | -5   | 0   | 5   | 20 |    |    |     |
| 03060112 | 5   | 18.5N  | 118.2E | 40     | 49   | 91   | 133  | 205 | 403  |      |    |     | -5  | -5   | 0   | 10  | 25 |    |    |     |
| 03060118 | 6   | 19.2N  | 118.9E | 45     | 22   | 46   | 81   | 144 | 270  |      |    |     | -5  | 5    | 10  | 20  | 25 |    |    |     |
| 03060200 | 7   | 20.0N  | 119.6E | 45     | 23   | 66   | 101  | 217 | 283  |      |    |     | 0   | 5    | 15  | 20  | 25 |    |    |     |
| 03060206 | 8   | 20.8N  | 120.8E | 45     | 46   | 80   | 172  | 312 |      |      |    |     | 5   | 10   | 20  | 25  |    |    |    |     |
| 03060212 | 9   | 21.5N  | 122.0E | 45     | 30   | 56   | 88   | 200 |      |      |    |     | 5   | 10   | 15  | 15  |    |    |    |     |
| 03060218 | 10  | 22.2N  | 123.3E | 45     | 16   | 78   | 185  |     |      |      |    |     | -15 | -5   | 5   |     |    |    |    |     |
| 03060300 | 11  | 23.0N  | 125.3E | 40     | 5    | 66   | 154  |     |      |      |    |     | -10 | 0    | 0   |     |    |    |    |     |
| 03060306 |     | 24.1N  | 127.9E | 35     |      |      |      |     |      |      |    |     |     |      |     |     |    |    |    |     |

26 69 134 214 309 645

9

7

3

11 11 11

12 15 22

15 22

7 3

4 5 7

-2

5

11 11 11 9

03060312

03060318

03060400

25.6N 130.9E

27.4N 133.8E

29.4N 136.8E

**AVERAGE** 

# CASES

BIAS

30

25

25

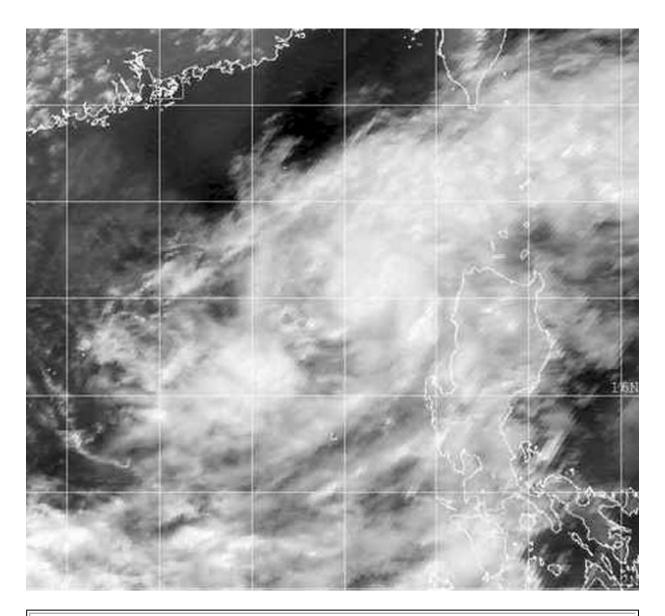
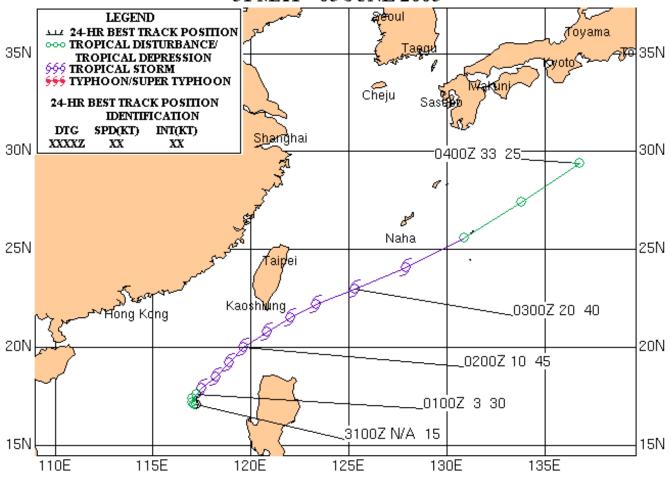
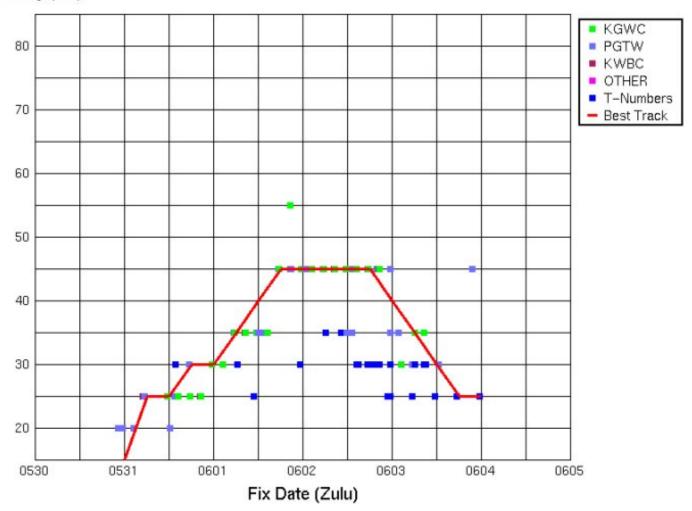


Figure 1-06W-1. 010630Z June 2003 Goes-9 visible imagery of TS 06W (Nangka), located in the south china sea northwest of Luzon with an estimated intensity of 35 knots.

#### TROPICAL STORM 06W (NANGKA) 31 MAY - 03 JUNE 2003



## Time Intensity for 06W



### Typhoon (TY) 07W (Soudelor)\*



First Poor: 0600Z 09 Jun 03

First Fair: 1600Z 09 Jun 03

First TCFA: 2100Z 09 Jun 03

First Warning: 1800Z 11 Jun 03

Last Warning: 1800Z 18 Jun 03

Max Intensity: 115 kts, gusts to 140 kts

Landfall: None

Total Warnings: 33

#### Remarks:

(1) Typhoon (TY) 07W was first noted on 09 June as an area of heavy convection; within 15 hours a Tropical Cyclone Formation Alert had been issued for this area. Over the next 45 hours the cyclone developed very slowly due to vertical wind shear inhibiting development. After 1200Z on 11 June, vertical wind shear had decreased, which allowed the cyclone to develop at a climatological rate for 48 hours, intensifying to 50 knots as it tracked west, south of the subtropical ridge. By 0000Z on 14 June, the cyclone began to move more poleward, into a weakness in the subtropical ridge associated with a mid-latitude longwave trough. During the intial poleward movement, the low level circulation center (Ilcc) had become partially exposed and intensity decreased to 45 knots. After 24 hours, the Ilcc moved under the deep convection, however the rate of intensification was slightly below 1 Dvorak T-number / day as the cyclone moved toward the Ryukyu Islands.

At around 1200Z on 17 June, when TY 07W was east of Taiwan, it began to rapidly intensify at a rate of 1.5 Dvorak T-numbers in 18 hours, then attained peak intensity of 115 knots around 0600Z on 18 June. Intensification was enhanced by upper level outflow into the mid-latitude longwave trough while TY 07W was moving north-northeastward, poleward of the subtropical ridge axis. After peak intensity was attained, the cyclone experienced vertical wind shear, associated with the mid-latitude westerlies, and began to rapidly weaken and transition to an extratropical system.

(2) Although TY 07W came close to several land masses, reports of damage were noted from only one region. Damage reports from the Philippines indicated there were 11 casualties and thousands of persons temporarily displaced by flooding due to heavy rains associated with this cyclone.

|          |     |       |        | Stat | isti | cs fo | or J7 | rwc | on  | TYO | 7W  |     |    |              |          |     |    |    |    |     |
|----------|-----|-------|--------|------|------|-------|-------|-----|-----|-----|-----|-----|----|--------------|----------|-----|----|----|----|-----|
|          | WRN | BEST  | TRACK  |      | PO   | SITI  | ON E  | RRC | )RS |     |     |     | WI | ND           | ERF      | ROR | 'S |    |    |     |
| DTG      | NO. | LAT   | LONG   | wind |      | _     | 24    | 36  | 48  | 72  | 96  | 120 |    |              | 24       |     |    | 72 | 96 | 120 |
| 03060700 |     | 8.2N  | 155.8E | 15   |      | ]     |       |     |     |     |     |     |    | J - <u>-</u> | <u> </u> |     |    |    |    | . — |
| 03060706 |     | 8.2N  | 153.8E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060712 |     | 8.1N  | 152.2E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060718 |     | 8.2N  | 151.4E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060800 | )   | 8.2N  | 150.8E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060806 |     | 8.3N  | 150.2E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060812 |     | 8.4N  | 149.7E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060818 |     | 8.6N  | 149.1E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060900 |     | 8.7N  | 148.4E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060906 |     | 8.8N  | 147.4E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060912 |     | 8.9N  | 146.3E | 15   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03060918 |     | 9.1N  | 145.4E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061000 |     | 9.4N  | 144.6E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061006 |     | 9.5N  | 143.8E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061012 |     | 9.6N  | 142.9E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061018 |     | 9.6N  | 141.8E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061100 |     | 9.6N  | 140.7E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061106 |     | 9.6N  | 139.5E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061112 |     | 9.4N  | 138.4E | 20   |      |       |       |     |     |     |     |     |    |              |          |     |    |    |    |     |
| 03061118 | 1   | 9.4N  | 137.2E | 25   | 5    | 48    | 62    | 118 | 147 | 60  |     |     | 0  | 0            | 5        | -5  | -5 | 20 |    |     |
| 03061200 | 2   | 9.5N  | 135.9E | 25   | 0    | 49    | 88    | 60  | 117 | 254 |     |     | 0  | 0            | 0        | -5  | 0  | 20 |    |     |
| 03061206 | 3   | 9.8N  | 134.7E | 30   | 31   | 89    | 88    | 111 | 190 | 295 |     |     | 0  | 5            | -5       | -5  | 10 | 15 |    |     |
| 03061212 | 4   | 10.1N | 133.8E | 30   | 13   | 19    | 80    | 114 | 102 | 225 | 186 | 181 | 0  | 0            | -5       | -5  | 15 | 20 | 0  | 0   |
| 03061218 | 5   | 10.4N | 132.9E | 30   | 35   | 106   | 147   | 131 | 81  | 13  | 61  | 134 | 0  | -<br>10      | -<br>10  | 20  | 40 | 35 | 40 | 15  |
| 03061300 | 6   | 10.8N | 131.7E | 35   | 11   | 86    | 141   | 123 | 58  | 21  | 84  | 147 | 0  | -5           | 5        | 30  | 45 | 40 | 30 | 5   |

| 03061306 | 7  | 11.3N    | 130.4E | 45  | 24 | 100 | 135 | 117 | 102 | 134 | 209 | 208 | 0  | 5       | 25      | 45      | 50      | 45      | 20      | -40 |
|----------|----|----------|--------|-----|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03061312 | 8  | 11.5N    | 129.1E | 45  | 41 | 111 | 118 | 89  | 98  | 138 | 254 | 345 | 0  | 5       | 30      | 50      | 45      | 45      | 15      | -50 |
| 03061318 | 9  | 11.5N    | 128.2E | 50  | 18 | 76  | 133 | 185 | 221 | 103 | 105 | 161 | 0  | 15      | 25      | 30      | 10      | 0       | -<br>30 | -30 |
| 03061400 | 10 | 11.4N    | 127.4E | 50  | 23 | 84  | 141 | 143 | 141 | 132 | 281 | 336 | 0  | 15      | 0       | -<br>15 | -<br>15 | -<br>35 | -<br>55 | -25 |
| 03061406 | 11 | 12.0N    | 127.0E | 45  | 13 | 30  | 71  | 75  | 73  | 29  | 100 | 242 | 0  | 5       | 0       | -5      | 5       | -<br>10 | -<br>60 | -25 |
| 03061412 | 12 | 12.4N    | 126.6E | 45  | 5  | 55  | 58  | 46  | 32  | 16  | 147 | 362 | 0  | 5       | -5      | -5      | 5       | -<br>15 | -<br>65 | -20 |
| 03061418 | 13 | 13.1N    | 126.4E | 45  | 5  | 24  | 76  | 112 | 151 | 175 | 239 | 321 | 0  | 5       | 0       | 10      | 10      | -<br>35 | -<br>40 | -15 |
| 03061500 | 14 | 13.8N    | 126.2E | 45  | 33 | 97  | 133 | 185 | 217 | 262 | 245 | 235 | 0  | 0       | 0       | 10      | 0       | -<br>50 | -<br>30 | -10 |
| 03061506 | 15 | 14.4N    | 125.9E | 50  | 21 | 67  | 92  | 144 | 163 | 267 | 284 |     | -5 | -<br>10 | 0       | 0       | -<br>10 | -<br>70 | -<br>30 |     |
| 03061512 | 16 | 14.9N    | 125.4E | 55  | 18 | 37  | 88  | 117 | 152 | 250 | 187 |     | 0  | 0       | 15      | 0       | -<br>10 | -<br>65 | -<br>15 |     |
| 03061518 | 17 | 15.6N    | 124.9E | 60  | 6  | 23  | 72  | 87  | 115 | 108 | 163 |     | 0  | 10      | 10      | 0       | -<br>25 | -<br>35 | -<br>10 |     |
| 03061600 | 18 | 16.5N    | 124.5E | 60  | 17 | 59  | 90  | 109 | 122 | 84  | 327 |     | 0  | 10      | 0       | 5       | -<br>40 | -<br>25 | -<br>10 |     |
| 03061606 | 19 | 17.3N    | 124.0E | 60  | 16 | 51  | 53  | 18  | 34  | 236 |     |     | 0  | 5       | 5       | -<br>20 | -<br>55 | -<br>20 |         |     |
| 03061612 | 20 | 18.1N    | 123.4E | 60  | 8  | 13  | 17  | 34  | 16  | 230 |     |     | 0  | -5      | 0       | -<br>30 | -<br>60 | -<br>15 |         |     |
| 03061618 | 21 | 19.0N    | 123.0E | 65  | 5  | 29  | 35  | 16  | 57  | 152 |     |     | 0  | 10      | -5      | -<br>45 | -<br>30 | -5      |         |     |
| 03061700 | 22 | 20.0N    | 123.1E | 75  | 8  | 8   | 40  | 16  | 93  | 174 |     |     | 0  | 15      | -<br>20 | -<br>50 | -<br>20 | -5      |         |     |
| 03061706 | 23 | 20.8N    | 123.2E | 75  | 5  | 24  | 25  | 75  | 151 |     |     |     | 0  | -<br>15 | -<br>50 | -<br>35 | -<br>25 |         |         |     |
| 03061712 | 24 | 22.1N    | 123.6E | 75  | 8  | 100 | 225 | 198 | 175 |     |     |     | 0  | -<br>10 | -<br>45 | -<br>20 | -<br>15 |         |         |     |
| 03061718 | 25 |          | 123.8E | 90  | 0  | 67  | 41  | 74  | 63  |     |     |     | 0  |         | -<br>20 |         |         |         |         |     |
| 03061800 | 26 |          | 123.9E | 100 |    |     | 57  |     | 118 |     |     |     | 0  |         |         | 0       | -5      |         |         |     |
|          | 27 |          | 124.5E | 115 |    | 62  |     | 159 |     |     |     |     | 0  |         | 20      |         |         |         |         |     |
| 03061812 | 28 |          | 125.4E |     |    | 73  |     | 147 |     |     |     |     | 0  | 20      | 10      | 0       |         |         |         |     |
| 03061818 | 29 | <u> </u> | 127.1E | 85  |    | 42  | 70  |     |     |     |     |     | 0  | -5      | 0       |         |         |         |         |     |
|          | 30 |          | 128.5E | 70  |    |     | 60  |     |     |     |     |     |    | 0       | -5      |         |         |         |         |     |
| 03061906 | 31 |          | 130.1E | 65  |    | 84  |     |     |     |     |     |     | 0  | 5       |         |         |         |         |         |     |
| 03061912 | 32 | 37.4N    | 132.5E | 55  | 7  | 33  |     |     |     |     |     |     | 0  | -5      |         |         |         |         |         |     |

| 03061918 | 33 | 39.2N | 134.9E  | 45 | 30 |    |    |     |     |     |     |     | 0  |    |    |    |    |    |         |     |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|----|----|----|----|----|---------|-----|
| 03062000 |    | 40.5N | 137.2E  | 45 |    |    |    |     |     |     |     |     |    |    |    |    |    |    |         |     |
|          |    |       | AVERAGE |    | 16 | 57 | 90 | 104 | 115 | 153 | 191 | 243 | 0  | 8  | 11 | 17 | 21 | 28 | 30      | 21  |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 0  | 2  | -1 | -1 | -3 | -7 | -<br>16 | -18 |
|          |    |       | # CASES |    | 33 | 32 | 30 | 28  | 26  | 22  | 15  | 11  | 33 | 32 | 30 | 28 | 26 | 22 | 15      | 11  |

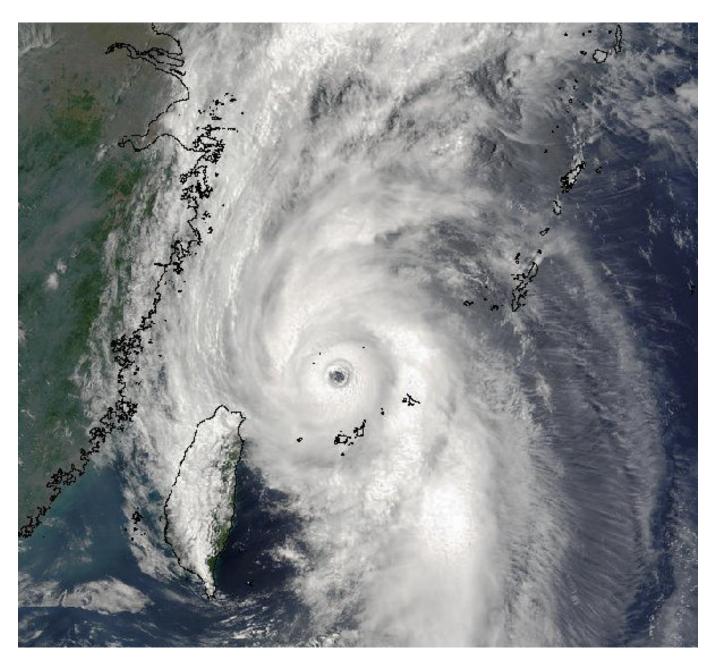


Figure 1-07W-1. 180225Z June 2003 MODIS true-color image of TY 07W (Soudelor), located 105nm east of Taiwan, with an intensity of 100 knots.

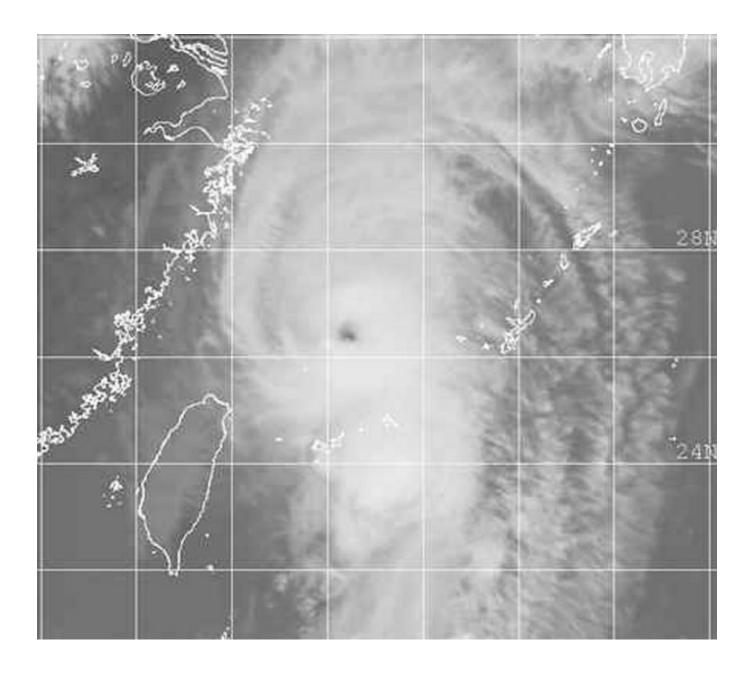


Figure 1-07W-2. 180644Z June 2003 Goes-9 infrared imagery of TY 07W (Soudelor), located 175 nm west-southwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

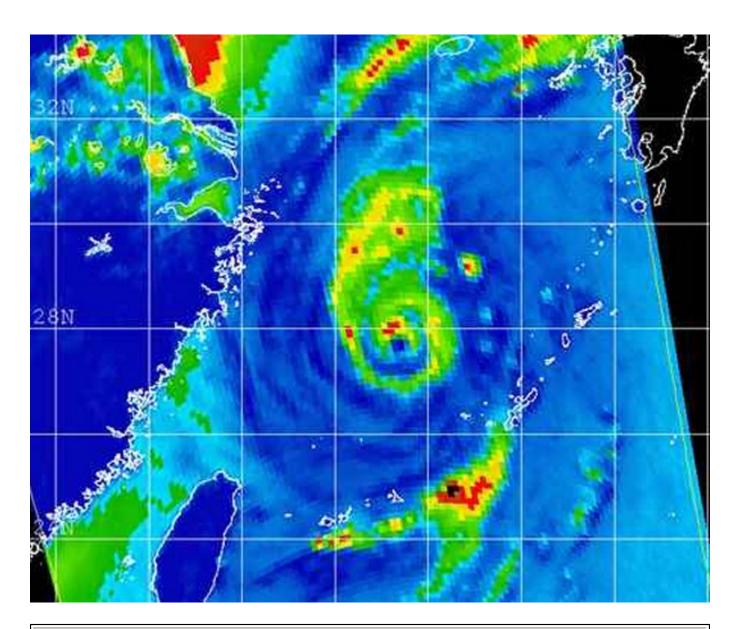
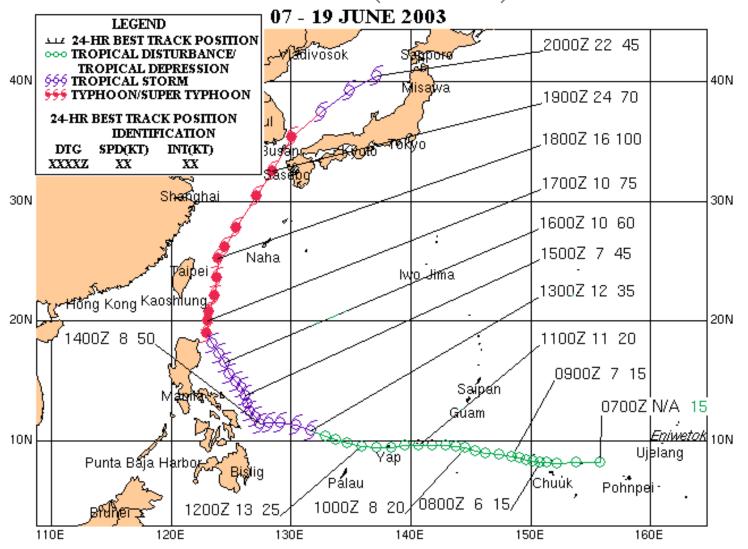
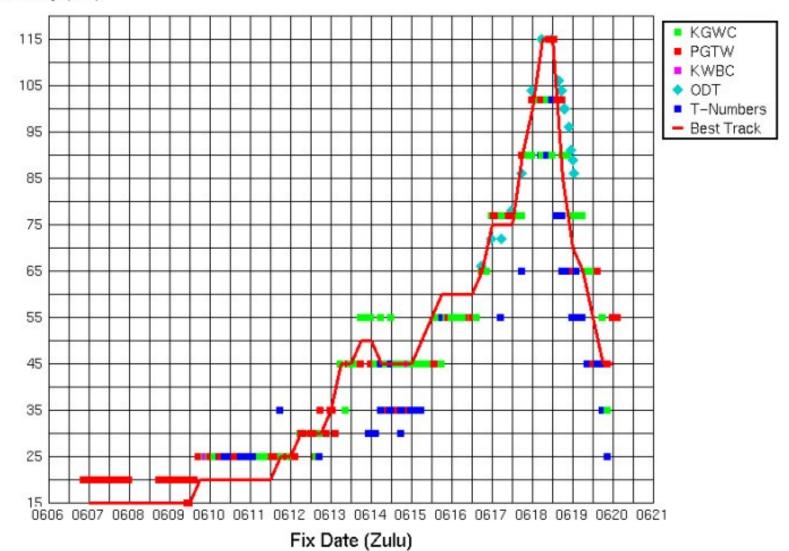


Figure 1-07W-3. 181120Z June 2003 85 GHz SSM/I imagery of TY 07W (Soudelor), located 150 nm west-northwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

#### TYPHOON 07W (SOUDELOR)



# Time Intensity for 07W



## Typhoon (TY) 07W (Soudelor)\*



First Poor : 0600Z 09 Jun 03

First Fair: 1600Z 09 Jun 03

First TCFA: 2100Z 09 Jun 03

First Warning: 1800Z 11 Jun 03

Last Warning: 1800Z 18 Jun 03

Max Intensity: 115 kts, gusts to 140 kts

Landfall: None

Total Warnings: 33

### Remarks:

(1) Typhoon (TY) 07W was first noted on 09 June as an area of heavy convection and within 15 hours a Tropical Cyclone Formation Alert had been issued for this area. Over the next 45 hours the cyclone developed very slowly due to vertical wind shear limiting development. After 1200Z on 11 June, vertical wind shear had decreased, which allowed the cyclone to develop at a climatological rate for 48 hours, intensifying to 50 knots as it tracked west, south of the subtropical ridge. By 0000Z on 14 June, the cyclone began to move more poleward, into a weakness in the subtropical ridge associated with a midlatitude longwave trough. During the intial poleward movement, the low level circulation center (Ilcc) had become partially exposed and intensity decreased to 45 knots. After 24 hours, the Ilcc moved under the deep convection, however the rate of intensification was slightly below 1 Dvorak T-number / day as the cyclone moved toward the Ryukyu Islands.

At around 1200Z on 17 June, when TY 07W was east of Taiwan, it began to rapidly intensify at a rate of 1.5 Dvorak T-numbers in 18 hours, then attained peak intensity of 115 knots around 0600Z on 18 June. Intensification was enhanced by upper level outflow into the mid-latitude longwave trough while TY 07W was moving north-northeastward, poleward of the subtropical ridge axis. After peak intensity was attained, the cyclone experienced vertical wind shear, associated with the mid-latitude westerlies, and began to rapidly weaken and transition to an extratropical system.

(2) Although TY 07W came close to several land masses, reports of damage were noted from only one region. Damage reports from the Philippines indicated there were 11 casualties and thousands of persons temporarily displaced by flooding due to heavy rains associated with this cyclone.

\*Named by WMO Designated RSMC

|          |      |       |        | Stati | isti | cs fo | or Jī | ΓWC | on  | TY0 | 7W  |     |    |         |         |         |         |         |         |     |
|----------|------|-------|--------|-------|------|-------|-------|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          | WRN  | BEST  | TRACK  |       | PO   | SITI  | ON F  | RRC | )RS |     |     |     | WI | ND      | FRF     | ROR     | es.     |         |         |     |
| DTG      | NO.  | LAT   | LONG   | wind  |      |       | 24    | 36  | 48  | 72  | 96  | 120 |    |         |         |         |         | 72      | 96      | 120 |
| 03060700 | 110. | 8.2N  | 155.8E | 15    |      | -     |       |     |     | -   |     | 120 |    | 12      |         |         | 10      | -       |         | 120 |
| 03060706 |      | 8.2N  | 153.8E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060712 |      | 8.1N  | 152.2E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060718 |      | 8.2N  | 151.4E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060800 |      | 8.2N  | 150.8E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060806 |      | 8.3N  | 150.2E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060812 |      | 8.4N  | 149.7E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060818 |      | 8.6N  | 149.1E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060900 |      | 8.7N  | 148.4E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060906 |      | 8.8N  | 147.4E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060912 |      | 8.9N  | 146.3E | 15    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03060918 |      | 9.1N  | 145.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061000 |      | 9.4N  | 144.6E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061006 |      | 9.5N  | 143.8E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061012 |      | 9.6N  | 142.9E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061018 |      | 9.6N  | 141.8E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061100 |      | 9.6N  | 140.7E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061106 |      | 9.6N  | 139.5E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061112 |      | 9.4N  | 138.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03061118 | 1    | 9.4N  | 137.2E | 25    | 5    | 48    | 62    | 118 | 147 | 60  |     |     | 0  | 0       | 5       | -5      | -5      | 20      |         |     |
| 03061200 | 2    | 9.5N  | 135.9E | 25    | 0    | 49    | 88    | 60  | 117 | 254 |     |     | 0  | 0       | 0       | -5      | 0       | 20      |         |     |
| 03061206 | 3    | 9.8N  | 134.7E | 30    | 31   | 89    | 88    | 111 | 190 | 295 |     |     | 0  | 5       | -5      | -5      | 10      | 15      |         |     |
| 03061212 | 4    | 10.1N | 133.8E | 30    | 13   | 19    | 80    | 114 | 102 | 225 | 186 | 181 | 0  | 0       | -5      | -5      | 15      | 20      | 0       | 0   |
| 03061218 | 5    | 10.4N | 132.9E | 30    | 35   | 106   | 147   | 131 | 81  | 13  | 61  | 134 | 0  | -<br>10 | -<br>10 | 20      | 40      | 35      | 40      | 15  |
| 03061300 | 6    | 10.8N | 131.7E | 35    | 11   | 86    | 141   | 123 | 58  | 21  | 84  | 147 | 0  | -5      | 5       | 30      | 45      | 40      | 30      | 5   |
| 03061306 | 7    | 11.3N | 130.4E | 45    | 24   | 100   | 135   | 117 | 102 | 134 | 209 | 208 | 0  | 5       | 25      | 45      | 50      | 45      | 20      | -40 |
| 03061312 | 8    | 11.5N | 129.1E | 45    | 41   | 111   | 118   | 89  | 98  | 138 | 254 | 345 | 0  | 5       | 30      | 50      | 45      | 45      | 15      | -50 |
| 03061318 | 9    | 11.5N | 128.2E | 50    | 18   | 76    | 133   | 185 | 221 | 103 | 105 | 161 | 0  | 15      | 25      | 30      | 10      | 0       | -<br>30 | -30 |
| 03061400 | 10   | 11.4N | 127.4E | 50    | 23   | 84    | 141   | 143 | 141 | 132 | 281 | 336 | 0  | 15      | 0       | -<br>15 | -<br>15 | -<br>35 | -<br>55 | -25 |

| 03061406 | 11 | 12.0N | 127.0E  | 45  | 13 | 30  | 71  | 75  | 73  | 29  | 100 | 242 | 0  | 5       | 0       | -5      | 5       | -<br>10 | -<br>60 | -25 |
|----------|----|-------|---------|-----|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03061412 | 12 | 12.4N | 126.6E  | 45  | 5  | 55  | 58  | 46  | 32  | 16  | 147 | 362 | 0  | 5       | -5      | -5      | 5       | -<br>15 | -<br>65 | -20 |
| 03061418 | 13 | 13.1N | 126.4E  | 45  | 5  | 24  | 76  | 112 | 151 | 175 | 239 | 321 | 0  | 5       | 0       | 10      | 10      | -<br>35 | -<br>40 | -15 |
| 03061500 | 14 | 13.8N | 126.2E  | 45  | 33 | 97  | 133 | 185 | 217 | 262 | 245 | 235 | 0  | 0       | 0       | 10      | 0       | -<br>50 | -<br>30 | -10 |
| 03061506 | 15 | 14.4N | 125.9E  | 50  | 21 | 67  | 92  | 144 | 163 | 267 | 284 |     | -5 | -<br>10 | 0       | 0       | -<br>10 | -<br>70 | -<br>30 |     |
| 03061512 | 16 | 14.9N | 125.4E  | 55  | 18 | 37  | 88  | 117 | 152 | 250 | 187 |     | 0  | 0       | 15      | 0       | -<br>10 | -<br>65 | -<br>15 |     |
| 03061518 | 17 | 15.6N | 124.9E  | 60  | 6  | 23  | 72  | 87  | 115 | 108 | 163 |     | 0  | 10      | 10      | 0       | -<br>25 | -<br>35 | -<br>10 |     |
| 03061600 | 18 | 16.5N | 124.5E  | 60  | 17 | 59  | 90  | 109 | 122 | 84  | 327 |     | 0  | 10      | 0       | 5       | -<br>40 | -<br>25 | -<br>10 |     |
| 03061606 | 19 | 17.3N | 124.0E  | 60  | 16 | 51  | 53  | 18  | 34  | 236 |     |     | 0  | 5       | 5       | -<br>20 | -<br>55 | -<br>20 |         |     |
| 03061612 | 20 | 18.1N | 123.4E  | 60  | 8  | 13  | 17  | 34  | 16  | 230 |     |     | 0  | -5      | 0       | -<br>30 | -<br>60 | -<br>15 |         |     |
| 03061618 | 21 | 19.0N | 123.0E  | 65  | 5  | 29  | 35  | 16  | 57  | 152 |     |     | 0  | 10      | -5      | -<br>45 | -<br>30 | -5      |         |     |
| 03061700 | 22 | 20.0N | 123.1E  | 75  | 8  | 8   | 40  | 16  | 93  | 174 |     |     | 0  | 15      | -<br>20 | -<br>50 | -<br>20 | -5      |         |     |
| 03061706 | 23 | 20.8N | 123.2E  | 75  | 5  | 24  | 25  | 75  | 151 |     |     |     | 0  | -<br>15 | -<br>50 | -<br>35 | -<br>25 |         |         |     |
| 03061712 | 24 | 22.1N | 123.6E  | 75  | 8  | 100 | 225 | 198 | 175 |     |     |     | 0  | -<br>10 | -<br>45 | -<br>20 | -<br>15 |         |         |     |
| 03061718 | 25 | 23.6N | 123.8E  | 90  | 0  | 67  | 41  | 74  | 63  |     |     |     | 0  | -<br>30 | -<br>20 | -<br>15 | -5      |         |         |     |
| 03061800 | 26 | 25.2N | 123.9E  | 100 | 18 | 34  | 57  | 109 | 118 |     |     |     | 0  | -5      | 5       | 0       | -5      |         |         |     |
| 03061806 | 27 | 26.2N | 124.5E  | 115 | 17 | 62  | 120 | 159 |     |     |     |     | 0  | 30      | 20      | 20      |         |         |         |     |
| 03061812 | 28 | 27.8N | 125.4E  | 115 | 8  | 73  | 157 | 147 |     |     |     |     | 0  | 20      | 10      | 0       |         |         |         |     |
| 03061818 | 29 | 30.4N | 127.1E  | 85  | 18 | 42  | 70  |     |     |     |     |     | 0  | -5      | 0       |         |         |         |         |     |
| 03061900 | 30 | 32.5N | 128.5E  | 70  | 0  | 52  | 60  |     |     |     |     |     | 0  | 0       | -5      |         |         |         |         |     |
| 03061906 | 31 | 35.4N | 130.1E  | 65  | 36 | 84  |     |     |     |     |     |     | 0  | 5       |         |         |         |         |         |     |
| 03061912 | 32 | 37.4N | 132.5E  | 55  | 7  | 33  |     |     |     |     |     |     | 0  | -5      |         |         |         |         |         |     |
| 03061918 | 33 | 39.2N | 134.9E  | 45  | 30 |     |     |     |     |     |     |     | 0  |         |         |         |         |         |         |     |
| 03062000 |    | 40.5N | 137.2E  | 45  |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |    |       | AVERAGE |     | 16 | 57  | 90  | 104 | 115 | 153 | 191 | 243 | 0  | 8       | 11      | 17      | 21      | 28      | 30      | 21  |
|          |    |       | BIAS    |     |    |     |     |     |     |     |     |     | 0  | 2       | -1      | -1      | -3      | -7      | -<br>16 | -18 |
|          |    |       | # CASES |     | 33 | 32  | 30  | 28  | 26  | 22  | 15  | 11  | 33 | 32      | 30      | 28      | 26      | 22      | 15      | 11  |

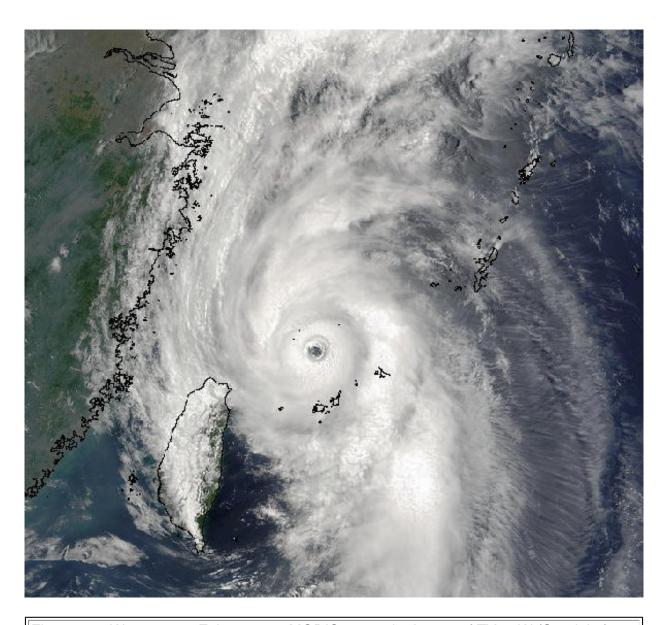


Figure 1-07W-1. 180225Z June 2003 MODIS true-color image of TY 07W (Soudelor), located 105nm east of Taiwan, with an intensity of 100 knots.

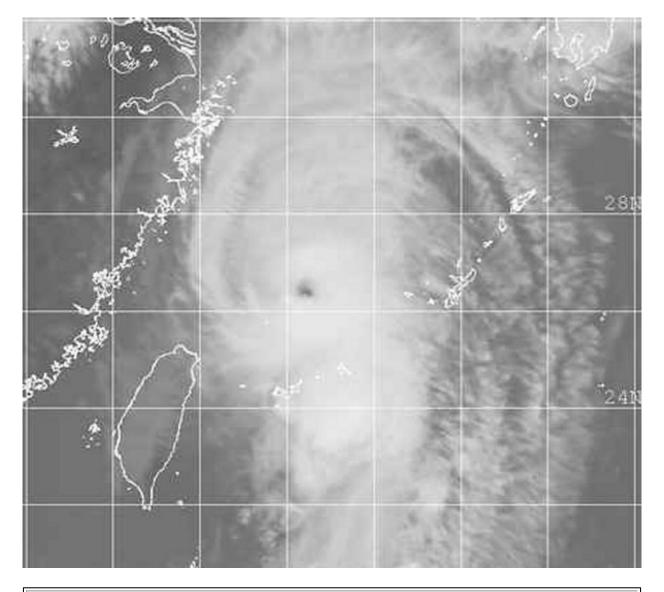


Figure 1-07W-2. 180644Z June 2003 Goes-9 infrared imagery of TY 07W (Soudelor), located 175 nm west-southwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

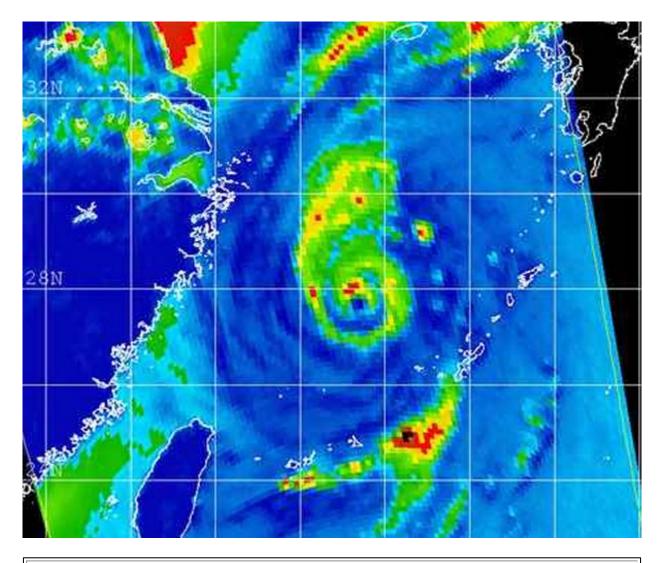
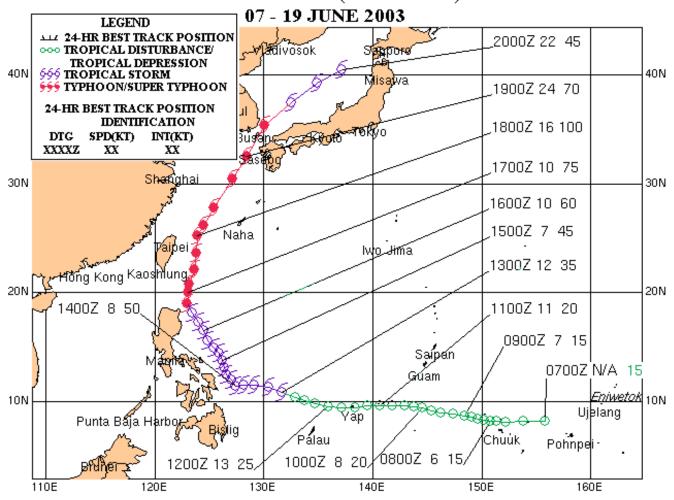
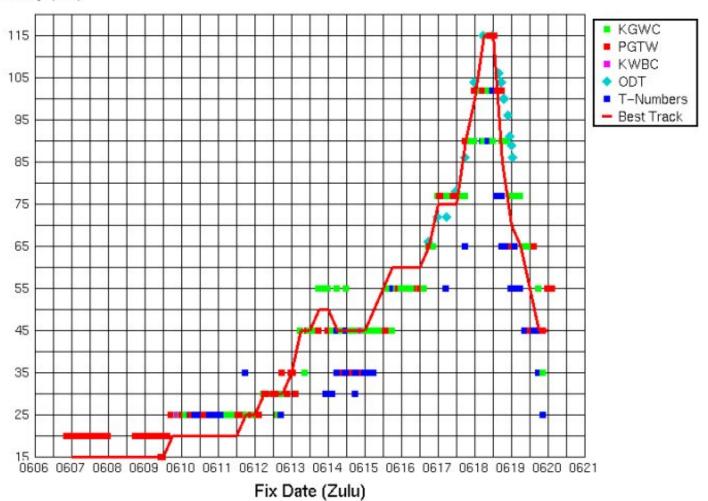


Figure 1-07W-3. 181120Z June 2003 85 GHz SSM/I imagery of TY 07W (Soudelor), located 150 nm west-northwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

### TYPHOON 07W (SOUDELOR)



# Time Intensity for 07W



## Typhoon (TY) 08W (Koni)\*



First Poor: 0600Z 11 Jul 03

First Fair: 0600 13 Jul 03

First TCFA: 0200 15 Jul 03

First Warning: 1200Z 15 Jul 03

Last Warning: 1800Z 22 Jul 03

Max Intensity: 65 kts, gusts to 80 kts

Landfall: Central Philippines, Hainan Island and North Vietnam

Total Warnings: 30

Remarks:

1) Typhoon (TY) 08W was first detected as a tropical disturbance northwest of Yap around 1200Z on 11 July. The first warning on this circulation was issed at 1200Z on 15 July.

The subtropical ridge situated to the north of the system provided the primary steering for TY 08W. As TY 08W tracked westward over the Philippines, land effects caused a brief period of weakening, which was eased as the system again tracked over open water in the South China Sea.

Subsequent to making landfall on Hainan Island, the cyclone tracked more westward and weakened as the ridge to the north began to build. TY 08W again made landfall, near Hanoi, Vietnam where it quickly dissipated over land. A final warning was issued at 1800Z on 22 July.

Although TY 08W had maximum winds of 65 knots, no well-formed eye was ever noted in any meteorological satellite data. Rather, the well-defined banding features of this cyclone was the reason TY 08W was designated as a typhoon.

2) Damages reported on Hainan Islands were moderate, with interruptions in air and maritime service being primary. Vietnam indicated three casualties and 18 injured. Approximately 1,000 homes destroyed with significant damage to agricultural interests.

|          |     |        |        | Statis | stic | s fo | r JT | WC  | on T | Y 08 | 3W  |     |    |         |         |         |         |         |         |     |
|----------|-----|--------|--------|--------|------|------|------|-----|------|------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |        |        |        |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
|          |     |        |        |        |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
|          |     | BEST 1 |        |        |      | SITI |      |     |      |      |     |     |    |         | ERF     |         |         |         |         |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00   | 12   | 24   | 36  | 48   | 72   | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03071412 |     | 10.5N  | 136.9E | 15     |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03071418 |     | 10.5N  | 135.7E | 15     |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03071500 |     | 10.4N  | 134.5E | 15     |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03071506 |     | 10.2N  | 133.3E | 20     |      |      |      |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03071512 | 1   | 10.0N  | 132.1E | 25     | 30   | 54   | 60   | 87  | 135  | 213  | 196 | 189 | 0  | 0       | 5       | -5      | 5       | 0       | 0       | -20 |
| 03071518 | 2   | 10.0N  | 130.9E | 25     | 6    | 13   | 54   | 104 | 190  | 284  | 306 | 334 | 0  | 0       | -5      | 0       | 5       | 0       | -5      | -20 |
| 03071600 | 3   | 10.1N  | 129.8E | 30     | 13   | 30   | 47   | 109 | 192  | 245  | 255 | 305 | 0  | 10      | 0       | 5       | 0       | -5      | -<br>15 | -25 |
| 03071606 | 4   | 10.3N  | 128.8E | 30     | 13   | 24   | 87   | 164 | 240  | 285  | 263 | 268 | 5  | 0       | 5       | 5       | 0       | -5      | -<br>20 | 5   |
| 03071612 | 5   | 10.6N  | 127.8E | 30     | 26   | 54   | 130  | 219 | 259  | 267  | 221 | 238 | 10 | 0       | 5       | 0       | -5      | -5      | -<br>20 | 5   |
| 03071618 | 6   | 10.9N  | 126.8E | 40     | 35   | 100  | 179  | 247 | 264  | 289  | 354 | 422 | 5  | 10      | 5       | 0       | 0       | -<br>15 | -<br>15 | 0   |
| 03071700 | 7   | 11.0N  | 125.7E | 45     | 6    | 85   | 180  | 218 | 238  | 253  | 241 | 289 | 0  | 0       | -5      | -5      | -<br>10 | -<br>20 | -<br>15 | 0   |
| 03071706 | 8   | 11.0N  | 124.5E | 40     | 6    | 71   | 149  | 174 | 171  | 121  | 173 | 247 | 0  | 0       | -<br>10 | -<br>10 | 0       | -<br>10 | 0       | 10  |
| 03071712 | 9   | 11.3N  | 123.2E | 40     | 11   | 67   | 100  | 120 | 109  | 62   | 121 | 231 | 0  | -<br>10 | -<br>10 | 0       | 10      | -5      | 10      | 25  |
| 03071718 | 10  | 11.5N  | 121.9E | 40     | 35   | 29   | 45   | 55  | 59   | 17   | 93  | 166 | 0  | 0       | 10      | 20      | 20      | 5       | 5       | 10  |
| 03071800 | 11  | 11.8N  | 120.5E | 45     | 48   | 34   | 30   | 34  | 17   | 13   | 62  |     | 0  | 5       | 15      | 20      | 10      | 5       | 0       |     |
| 03071806 | 12  | 12.4N  | 119.4E | 45     | 8    | 18   | 36   | 42  | 30   | 21   | 119 |     | -5 | 0       | 10      | 10      | -5      | 0       | -<br>10 |     |
| 03071812 | 13  | 13.0N  | 118.6E | 45     | 18   | 42   | 48   | 42  | 13   | 62   | 141 |     | -5 | 0       | 10      | 0       | -5      | 0       | 5       |     |
| 03071818 | 14  | 13.4N  | 117.9E | 45     | 21   | 34   | 23   | 34  | 50   | 97   | 210 |     | 0  | 5       | 5       | -5      | 0       | 10      | 10      |     |
| 03071900 | 15  | 13.9N  | 117.3E | 45     | 13   | 8    | 6    | 31  | 27   | 114  |     |     | 0  | 5       | -5      | -5      | 0       | -5      |         |     |
| 03071906 | 16  | 14.5N  | 116.7E | 45     | 8    | 17   | 24   | 21  | 8    | 102  |     |     | 0  | -5      | -<br>15 | -<br>10 | 0       | -<br>10 |         |     |

| 03071912 | 17 | 15.1N | 116.2E  | 45 | 5  | 21 | 26 | 33  | 48  | 138 |     |     | 0  | -<br>15 | -<br>15 | 10 | 10      | -5 |    |    |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|----|---------|----|----|----|
| 03071918 | 18 | 15.7N | 115.6E  | 50 | 5  | 13 | 19 | 24  | 83  | 198 |     |     | 0  | -5      | -5      | 5  | -<br>15 | 15 |    |    |
| 03072000 | 19 | 16.3N | 115.0E  | 60 | 13 | 13 | 13 | 25  | 103 |     |     |     | 5  | 10      | 15      | 15 | -5      |    |    |    |
| 03072006 | 20 | 17.0N | 114.3E  | 65 | 6  | 6  | 17 | 78  | 79  |     |     |     | 0  | 10      | 20      | 10 | 0       |    |    |    |
| 03072012 | 21 | 17.6N | 113.6E  | 65 | 0  | 24 | 40 | 99  | 100 |     |     |     | 0  | 10      | 20      | -5 | 15      |    |    |    |
| 03072018 | 22 | 18.0N | 112.8E  | 65 | 0  | 6  | 66 | 84  | 138 |     |     |     | 0  | 5       | 5       | 0  | 5       |    |    |    |
| 03072100 | 23 | 18.3N | 112.0E  | 65 | 0  | 21 | 96 | 110 |     |     |     |     | 0  | 10      | -<br>15 | 0  |         |    |    |    |
| 03072106 | 24 | 18.7N | 111.1E  | 60 | 0  | 54 | 76 | 128 |     |     |     |     | 5  | 0       | -5      | 0  |         |    |    |    |
| 03072112 | 25 | 18.8N | 110.0E  | 55 | 0  | 65 | 90 |     |     |     |     |     | 10 | -5      | 5       |    |         |    |    |    |
| 03072118 | 26 | 18.8N | 108.6E  | 60 | 34 | 62 | 25 |     |     |     |     |     | 5  | 0       | -5      |    |         |    |    |    |
| 03072200 | 27 | 18.9N | 107.3E  | 60 | 11 | 61 |    |     |     |     |     |     | 0  | 5       |         |    |         |    |    |    |
| 03072206 | 28 | 19.8N | 106.4E  | 55 | 11 | 50 |    |     |     |     |     |     | 0  | -5      |         |    |         |    |    |    |
| 03072212 | 29 | 20.1N | 105.0E  | 40 | 18 |    |    |     |     |     |     |     | 0  |         |         |    |         |    |    |    |
| 03072218 | 30 | 19.7N | 103.8E  | 35 | 24 |    |    |     |     |     |     |     | 0  |         |         |    |         |    |    |    |
|          |    |       | AVERAGE |    | 14 | 39 | 64 | 95  | 116 | 154 | 197 | 269 | 2  | 5       | 9       | 6  | 6       | 7  | 9  | 12 |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 1  | 1       | 2       | 1  | 1       | -3 | -5 | -1 |
|          |    |       | # CASES |    | 30 | 28 | 26 | 24  | 22  | 18  | 14  | 10  | 30 | 28      | 26      | 24 | 22      | 18 | 14 | 10 |

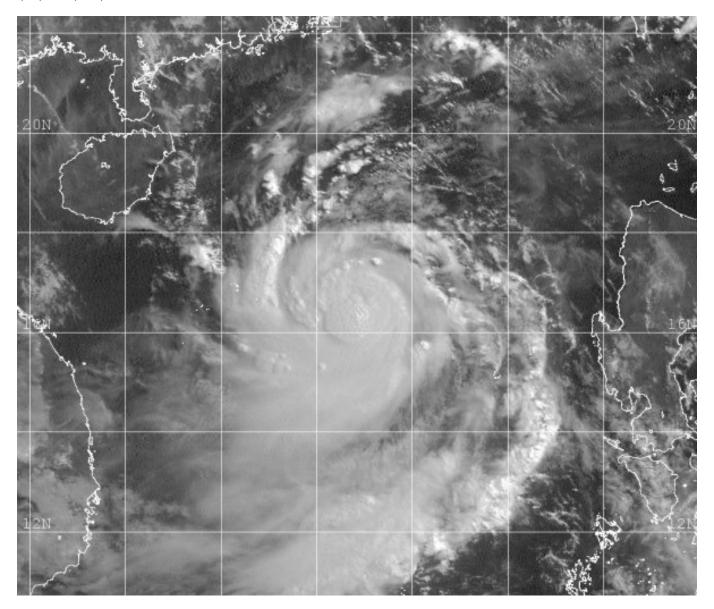


Figure 1-08W-1. 200001Z July 2003 GOES-9 visible satellite imagery of TY 08W (Koni), located 310 nm west of Luzon, Philippines in the south china sea at its peak intensity of 65 knots.

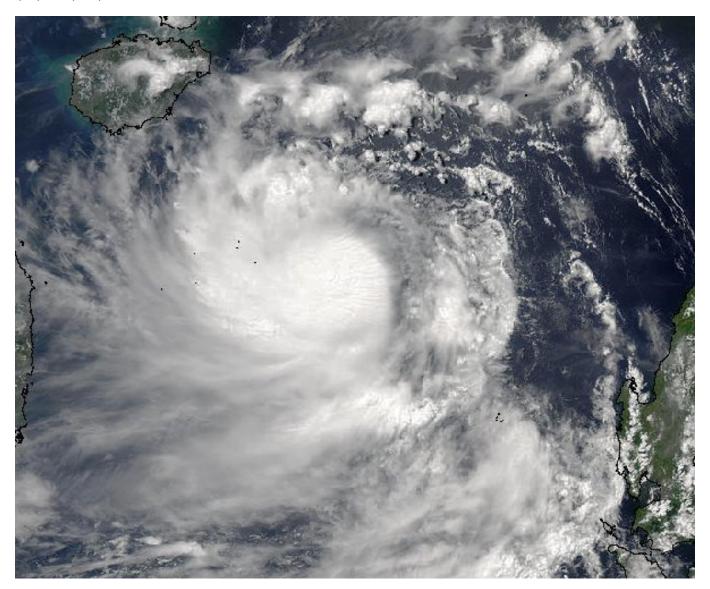
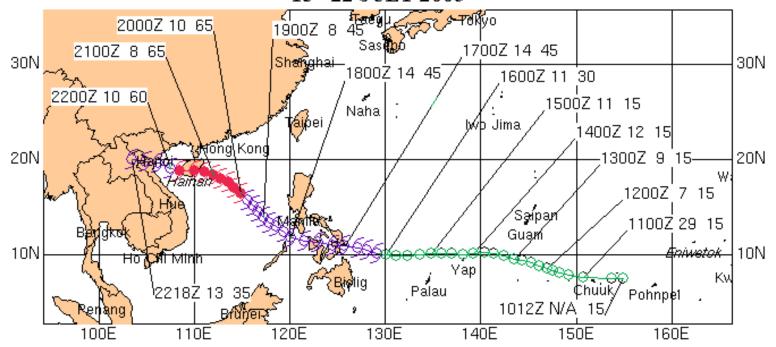


Figure 1-08W-2. 200530Z July 2003 MODIS true-color image of TY 08W (Koni), located in the South China Sea, with a maximum intensity of 65 knots.

### TYPHOON 08W (KONI) 15 - 22 JULY 2003



LEGEND

24-HR BEST TRACK POSITION

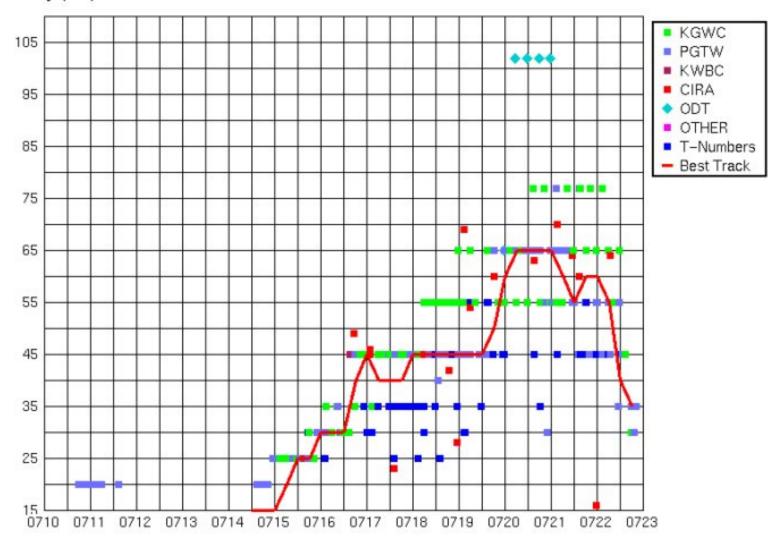
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION

555 TROPICAL STORM

TYPHOON/SUPER TYPHOON

24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX

## Time Intensity for 08W



## Typhoon (TY) 08W (Koni)



First Poor : 0600Z 11 Jul 03

First Fair: 0600 13 Jul 03

First TCFA: 0200 15 Jul 03

First Warning: 1200Z 15 Jul 03

Last Warning: 1800Z 22 Jul 03

Max Intensity: 65 kts, gusts to 80 kts

Landfall: Central Philippines, Hainan Island and North Vietnam

Total Warnings: 30

Remarks:

1) Typhoon (TY) 08W was first detected as a tropical disturbance northwest of Yap around 1200Z on 11 July. Subsequently, the first warning on this circulation was issed at 1200Z on 15 July.

Primary steering for the system was provided by the subtropical ridge situated to the north of the system. As TY 08W tracked westward over the Philippines, land effects caused a brief period of weakening, which was eased as the system again tracked over open water in the South China Sea.

Subsequent to making landfall on Hainan Island, the cyclone tracked more westward and weakened as the ridge to the north began to build. TY 08W again made landfall, near Hanoi, Vietnam where it quickly dissipated over land. A final warning was issued at 1800Z on 22 July.

Although TY 08W had maximum winds of 65 knots, no well-formed eye was ever noted in any meteorological satellite data. Rather, the well-defined banding features of this cyclone was the reason TY 08W was designated as a typhoon.

2) Damages reported on Hainan Islands were moderate, with interruptions in air and maritime service being primary. Vietnam indicated three casualties and 18 injured. Approximately 1,000 homes destroyed with significant damage to agricultural interests.

### Statistics for JTWC on TY 08W WRN BEST TRACK **POSITION ERRORS** WIND ERRORS DTG NO. LAT LONG wind 00 12 24 36 120 00 12 24 36 48 72 96 120 48 72 96 03071412 10.5N 136.9E 15 03071418 10.5N 135.7E 15 03071500 10.4N 134.5E 15 03071506 10.2N 133.3E 20 03071512 1 10.0N 132.1E 25 30 54 60 87 135 213 196 189 0 0 -5 5 0 0 -20 03071518 2 10.0N 130.9E 25 104 190 284 306 334 0 -20 6 13 54 0 -5 0 5 0 -5 03071600 3 10.1N 129.8E 30 13 30 47 109 192 245 255 305 0 10 0 5 0 -5 -25 15 30 03071606 4 10.3N 128.8E 13 24 87 164 240 285 263 268 5 0 5 5 0 -5 5 20 03071612 5 127.8E 30 130 219 259 267 221 238 10 0 10.6N 26 54 5 0 -5 -5 20 03071618 6 10.9N 126.8E 40 35 | 100 | 179 | 247 | 264 | 289 | 354 | 422 | 5 10 | 5 0 0 15 15 180 218 238 253 241 289 0 03071700 11.0N 125.7E 45 6 85 0 -5 -5 10 20 15 03071706 8 11.0N 124.5E 40 71 149 174 171 121 173 247 0 6 0 0 10 10 10 10 03071712 9 11.3N 123.2E 40 11 67 100 120 109 62 121 231 0 10 -5 10 25 0 10 10 11.5N 03071718 10 121.9E 40 35 29 45 55 59 17 93 166 0 0 10 20 20 5 5 10 03071800 11 11.8N 120.5E 45 13 62 15 20 10 5 48 34 30 34 17 0 0 03071806 -5 12 12.4N 119.4E 45 8 36 42 30 21 119 0 10 | 10 18 -5 10 10 03071812 13 13.0N 118.6E 45 18 42 48 42 13 62 141 10 0 -5 5 -5 0 0 03071818 14 13.4N 117.9E 45 21 34 23 34 50 97 210 10 10 0 5 5 -5 0 03071900 15 13.9N 117.3E 45 13 | 8 6 31 27 114 0 5 -5 -5 0 -5 03071906 16 14.5N 116.7E 45 8 17 24 21 8 102 0 15 10 10 03071912 17 15.1N 116.2E 45 5 21 26 33 48 138 0 -5 15 15 10 10 03071918 18 15.7N 115.6E 50 5 13 19 24 83 198 0 -5 -5 |5 15 15 03072000 19 16.3N 115.0E 13 25 60 13 | 13 103 10 | 15 | 15 | -5

| 03072006 | 20 | 17.0N | 114.3E  | 65 | 6  | 6  | 17 | 78  | 79  |     |     |     | 0  | 10 | 20      | 10 | 0  |    |    |    |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|----|---------|----|----|----|----|----|
| 03072012 | 21 | 17.6N | 113.6E  | 65 | 0  | 24 | 40 | 99  | 100 |     |     |     | 0  | 10 | 20      | -5 | 15 |    |    |    |
| 03072018 | 22 | 18.0N | 112.8E  | 65 | 0  | 6  | 66 | 84  | 138 |     |     |     | 0  | 5  | 5       | 0  | 5  |    |    |    |
| 03072100 | 23 | 18.3N | 112.0E  | 65 | 0  | 21 | 96 | 110 |     |     |     |     | 0  | 10 | -<br>15 | 0  |    |    |    |    |
| 03072106 | 24 | 18.7N | 111.1E  | 60 | 0  | 54 | 76 | 128 |     |     |     |     | 5  | 0  | -5      | 0  |    |    |    |    |
| 03072112 | 25 | 18.8N | 110.0E  | 55 | 0  | 65 | 90 |     |     |     |     |     | 10 | -5 | 5       |    |    |    |    |    |
| 03072118 | 26 | 18.8N | 108.6E  | 60 | 34 | 62 | 25 |     |     |     |     |     | 5  | 0  | -5      |    |    |    |    |    |
| 03072200 | 27 | 18.9N | 107.3E  | 60 | 11 | 61 |    |     |     |     |     |     | 0  | 5  |         |    |    |    |    |    |
| 03072206 | 28 | 19.8N | 106.4E  | 55 | 11 | 50 |    |     |     |     |     |     | 0  | -5 |         |    |    |    |    |    |
| 03072212 | 29 | 20.1N | 105.0E  | 40 | 18 |    |    |     |     |     |     |     | 0  |    |         |    |    |    |    |    |
| 03072218 | 30 | 19.7N | 103.8E  | 35 | 24 |    |    |     |     |     |     |     | 0  |    |         |    |    |    |    |    |
|          |    |       | AVERAGE |    | 14 | 39 | 64 | 95  | 116 | 154 | 197 | 269 | 2  | 5  | 9       | 6  | 6  | 7  | 9  | 12 |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 1  | 1  | 2       | 1  | 1  | -3 | -5 | -1 |
|          |    |       | # CASES |    | 30 | 28 | 26 | 24  | 22  | 18  | 14  | 10  | 30 | 28 | 26      | 24 | 22 | 18 | 14 | 10 |

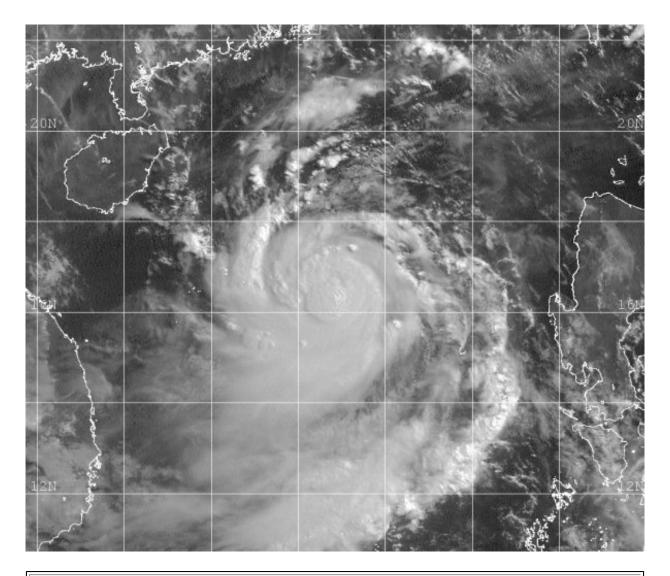


Figure 1-08W-1. 200001Z July 2003 GOES-9 visible satellite imagery of TY 08W (Koni), located 310 nm west of Luzon, Philippines in the south china sea at its peak intensity of 65 knots.

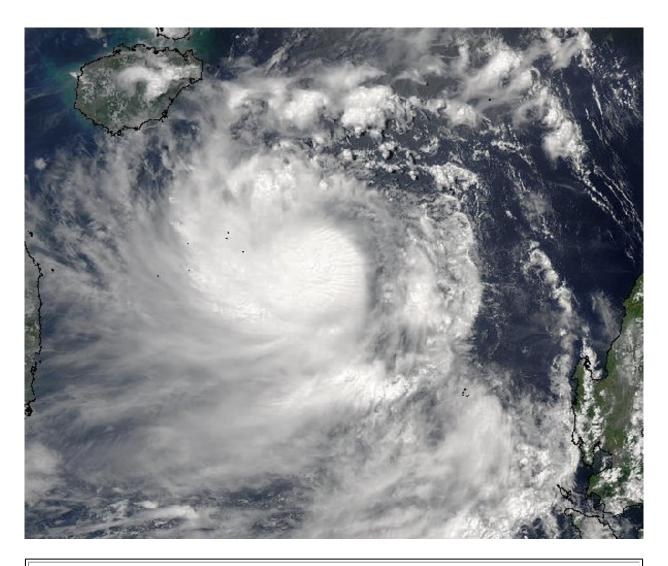
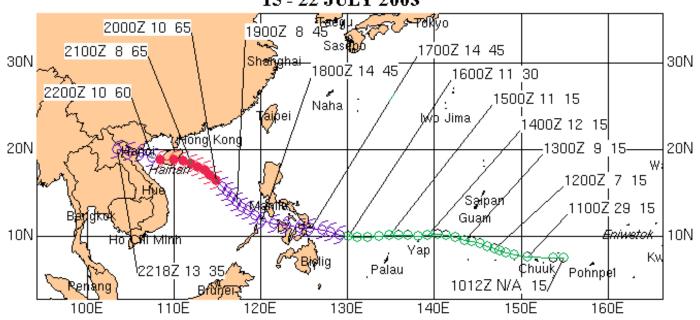


Figure 1-08W-2. 200530Z July 2003 MODIS true-color image of TY 08W (Koni), located in the South China Sea, with a maximum intensity of 65 knots.

### TYPHOON 08W (KONI) 15 - 22 JULY 2003



LEGEND

24-HR BEST TRACK POSITION

TROPICAL DISTURBANCE/
TROPICAL STORM

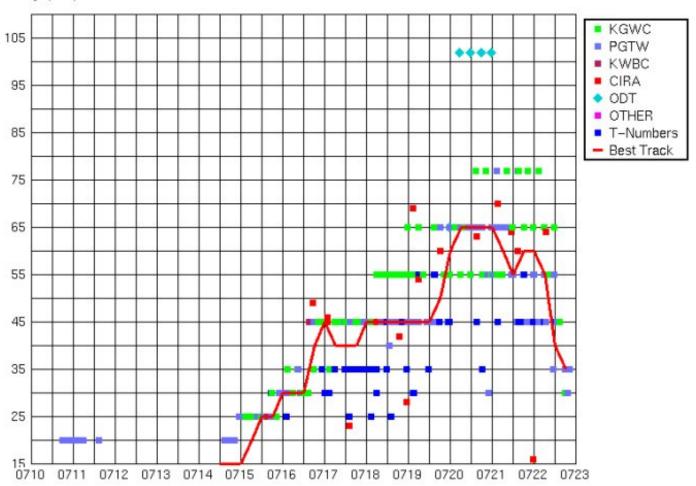
TROPICAL STORM

TYPHOON/SUPER TYPHOON

24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)

XXXXZ XX XX

## Time Intensity for 08W



## Super Typhoon (STY) 09W (Imbudo)\*



First Poor: 0600Z 14Jul 03

First Fair: 0600Z 15 Jul 03

First TCFA: 0930Z 16 Jul 03

First Warning: 1800Z 16 Jul 03

Last Warning: 1200Z 24 Jul 03

Max Intensity: 130 kts, gusts to 160 kts

Landfall: Yangjiang, China

Total Warnings: 32

Remarks:

1) Super Typhoon (STY) 09W was initially detected and monitored as an area of heavy convection very near Chuuk on 13 July 2003. Subsequently, another area of convection developed southwest of Chuuk around 15 July. For the next 48 hours this second area increased in organization and a first warning was issued by 1800Z on 16 July. The cyclone began to rapidly organize and track northwest along the southwestern periphery of the mid-level steering ridge. Favorable upper tropospheric synoptic flow and warm sea temperatures allowed for a steady rate of intensification slightly greater than climatological. A period of rapid development caused by an increase in equatorward outflow and increased outflow towards a TUTT cell to the northeast occurred from 0000Z on 19 July to 1200Z on 20 July resulted in an intensity increase of 2.5 Dvorak T-Numbers in just 36 hours.

The system then tracked northwest over Luzon, making landfall near 0300Z on 22 July with an estimated intensity of 110 knots and weakened only slightly over central Luzon. After emerging into the South China Sea, STY 09W tracked west-northwest at a rapid 15 knots and reintensified to 90 knots. The cyclone made landfall for a second time on the coast of China at approximately 0000Z on 24 July with an intensity of 85 knots. STY 09W then weakened over land and dissipated within 24 hours.

2) International news agencies reported 21 persons killed in the Philippines and as many as 20 casualties were reported in southern China. In the Philippines, crop damages were estimated at \$37 million. In Southern China, reports indicated that several small coastal reservoirs were damaged, many homes damaged or destroyed and significant losses in livestock experienced in some locations.

\*Named by WMO Designated RSMC

|          |     |       |        | Statis |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
|----------|-----|-------|--------|--------|----|-----|-----|-----|-----|-----|-----|-----|---------|---------|---------|---------|----------|---------|---------|-----|
|          | WRN | BEST  | TRACK  |        | РО | SIT | ION | ERR | ORS |     |     |     | WII     | ND E    | ERR     | OR      | <u> </u> |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind   | 00 | 12  | 24  | 36  | 48  | 72  | 96  | 120 | 00      | 12      | 24      | 36      | 48       | 72      | 96      | 120 |
| 03071500 |     | 3.6N  | 150.0E | 15     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071506 |     | 3.6N  | 148.9E | 15     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071512 |     | 3.6N  | 147.7E | 15     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071518 |     | 3.7N  | 146.5E | 15     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071600 |     | 4.3N  | 145.6E | 20     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071606 |     | 5.1N  | 144.9E | 20     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071612 |     | 5.8N  | 144.1E | 20     |    |     |     |     |     |     |     |     |         |         |         |         |          |         |         |     |
| 03071618 | 1   | 6.6N  | 143.2E | 25     | 33 | 73  | 113 | 161 | 205 | 253 |     |     | 0       | 5       | -5      | 0       | 5        | -5      |         |     |
| 03071700 | 2   | 7.4N  | 142.2E | 30     | 8  | 48  | 101 | 148 | 173 | 204 |     |     | 0       | 0       | 0       | 5       | 10       | -<br>15 |         |     |
| 03071706 | 3   | 8.2N  | 141.1E | 30     | 16 | 34  | 95  | 148 | 175 | 200 |     |     | 0       | -5      | -5      | -5      | -5       | -<br>25 |         |     |
| 03071712 | 4   | 8.8N  | 140.2E | 40     | 21 | 36  | 90  | 129 | 149 | 188 | 278 | 488 | 0       | 0       | 5       | 5       | -5       | -<br>35 | -<br>30 | 15  |
| 03071718 | 5   | 9.3N  | 139.4E | 45     | 5  | 48  | 77  | 118 | 128 | 183 | 347 | 503 | 0       | 0       | 0       | 0       | -5       | -<br>35 | -<br>25 | 5   |
| 03071800 | 6   | 9.7N  | 138.6E | 50     | 31 | 42  | 70  | 88  | 72  | 129 | 253 | 406 | 0       | 5       | 5       | -5      | -<br>15  | -<br>40 | -<br>20 | 5   |
| 03071806 | 7   | 9.9N  | 137.7E | 55     | 37 | 12  | 51  | 53  | 51  | 135 | 231 | 336 | 0       | 0       | 0       | -<br>10 | -<br>25  | -<br>30 | 5       | 5   |
| 03071812 | 8   | 10.1N | 136.9E | 55     | 8  | 30  | 43  | 47  | 82  | 174 | 299 | 385 | 0       | 0       | -<br>10 | -<br>15 | -<br>40  | -<br>30 | 15      | 5   |
| 03071818 | 9   | 10.4N | 136.1E | 65     | 8  | 22  | 17  | 24  | 71  | 225 | 337 | 390 | 0       | -5      | -<br>15 | -<br>30 | -<br>40  | -<br>15 | 25      | 40  |
| 03071900 | 10  | 10.4N | 135.3E | 65     | 8  | 8   | 12  | 39  | 105 | 265 | 372 | 434 | 0       | -<br>15 | -<br>25 | -<br>50 | -<br>40  | -5      | 25      | 20  |
| 03071906 | 11  | 10.5N | 134.6E | 75     | 5  | 13  | 6   | 39  | 102 | 213 | 281 | 389 | 0       | -<br>10 | -<br>25 | -<br>40 | -<br>25  | 30      | 30      | 30  |
| 03071912 | 12  | 10.7N | 133.9E | 85     | 11 | 17  | 18  | 60  | 117 | 234 | 296 | 361 | -<br>10 | -<br>20 | -<br>45 | -<br>35 | -<br>25  | 30      | 5       | 35  |

| 03071918 | 13 | 11.1N  | 133.2E  | 90  | 21 | 38 | 69  | 103  | 152 | 280 | 329 | 380 | -<br>10 | -       | -<br>35 | -<br>20 | -<br>10 | 25      | 30      | 45  |
|----------|----|--------|---------|-----|----|----|-----|------|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|-----|
|          |    | 44.001 | 100.45  | 100 | 10 |    |     | 4.40 | 400 | 004 |     | 400 | -       | -       | -       |         |         |         |         |     |
| 03072000 | 14 | 11.6N  | 132.4E  | 100 | 13 | 41 | 82  | 112  | 168 | 304 | 314 | 402 | 10      | 25      | 15      | -5      | 10      | 10      | 30      | 20  |
| 03072006 | 15 | 12.1N  | 131.5E  | 110 | 0  | 30 | 75  | 110  | 173 | 271 | 316 | 501 | 5       | 0       | 10      | 20      | 45      | 35      | -5      | -10 |
| 03072012 | 16 | 12.6N  | 130.5E  | 130 | 13 | 45 | 83  | 133  | 201 | 265 | 309 | 480 | 0       | 15      | 20      | 30      | 55      | 30      | 5       | -10 |
| 03072018 | 17 | 13.1N  | 129.4E  | 130 | 13 | 38 | 78  | 142  | 192 | 263 | 331 |     | 0       | 15      | 20      | 40      | 25      | 35      | 15      |     |
| 03072100 | 18 | 13.7N  | 128.2E  | 130 | 5  | 23 | 75  | 151  | 218 | 259 | 374 |     | 0       | 5       | 0       | 20      | -<br>10 | 0       | 15      |     |
| 03072106 | 19 | 14.3N  | 127.0E  | 125 | 8  | 37 | 102 | 152  | 205 | 258 | 310 |     | 5       | 10      | 35      | 10      | 10      | 5       | -<br>15 |     |
| 03072112 | 20 | 15.0N  | 125.8E  | 125 | 0  | 29 | 87  | 143  | 179 | 238 | 266 |     | 5       | 15      | 20      | 10      | 20      | 5       | -<br>10 |     |
| 03072118 | 21 | 15.7N  | 124.4E  | 120 | 5  | 42 | 92  | 149  | 181 | 249 |     |     | 10      | 30      | 0       | 15      | 5       | -<br>15 |         |     |
| 03072200 | 22 | 16.4N  | 123.0E  | 115 | 5  | 46 | 100 | 128  | 137 | 239 |     |     | 15      | 10      | 15      | 5       | 0       | -<br>10 |         |     |
| 03072206 | 23 | 17.0N  | 121.3E  | 90  | 16 | 53 | 88  | 107  | 139 | 306 |     |     | 0       | 15      | 5       | 0       | -<br>10 | -5      |         |     |
| 03072212 | 24 | 17.6N  | 119.8E  | 80  | 8  | 54 | 83  | 75   | 155 | 295 |     |     | 0       | 0       | -<br>10 | -<br>25 | -<br>25 | -5      |         |     |
| 03072218 | 25 | 18.1N  | 118.3E  | 90  | 20 | 50 | 74  | 76   | 130 |     |     |     | 0       | 5       | 15      | -<br>20 | -<br>10 |         |         |     |
| 03072300 | 26 | 18.5N  | 116.8E  | 90  | 16 | 42 | 36  | 70   | 147 |     |     |     | 0       | 5       | -<br>10 | -<br>15 | -<br>20 |         |         |     |
| 03072306 | 27 | 18.9N  | 115.4E  | 90  | 5  | 31 | 18  | 53   |     |     |     |     | 0       | -5      | -<br>30 | -<br>20 |         |         |         |     |
| 03072312 | 28 | 19.4N  | 114.2E  | 90  | 13 | 25 | 37  | 81   |     |     |     |     | -5      | -<br>10 | -<br>20 | -<br>20 |         |         |         |     |
| 03072318 | 29 | 19.8N  | 113.0E  | 85  | 8  | 85 | 81  | 100  |     |     |     |     | 5       | 10      | 0       | -<br>15 |         |         |         |     |
| 03072400 | 30 | 21.2N  | 111.9E  | 85  | 6  | 56 | 89  | 101  |     |     |     |     | 5       | -5      | -5      | -<br>10 |         |         |         |     |
| 03072406 | 31 | 22.0N  | 110.2E  | 75  | 5  | 17 | 50  |      |     |     |     |     | 5       | -5      | -5      |         |         |         |         |     |
| 03072412 | 32 | 22.8N  | 108.9E  | 55  | 12 | 79 |     |      |     |     |     |     | 0       | -5      |         |         |         |         |         |     |
| 03072418 |    |        | 107.5E  | 45  |    |    |     |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03072500 |    |        | 106.1E  | 40  |    |    |     |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03072506 |    | 23.8N  | 104.7E  | 35  |    |    |     |      |     |     |     |     |         |         |         |         |         |         |         |     |
| 03072512 |    | 24.7N  | 103.7E  | 30  |    |    |     |      |     |     |     |     |         |         |         |         |         |         |         |     |
|          |    |        | AVERAGE |     | 12 | 39 | 67  | 101  | 146 | 235 | 308 | 420 | 3       | 9       | 13      | 17      | 19      | 20      | 18      | 19  |
|          |    |        | BIAS    |     |    |    |     |      |     |     |     |     | 1       | 0       | -4      | -6      | -5      | -3      | 6       | 16  |
|          |    |        | # CASES |     | 32 | 32 | 31  | 30   | 26  | 24  | 17  | 13  | 32      | 32      | 31      | 30      | 26      | 24      | 17      | 13  |

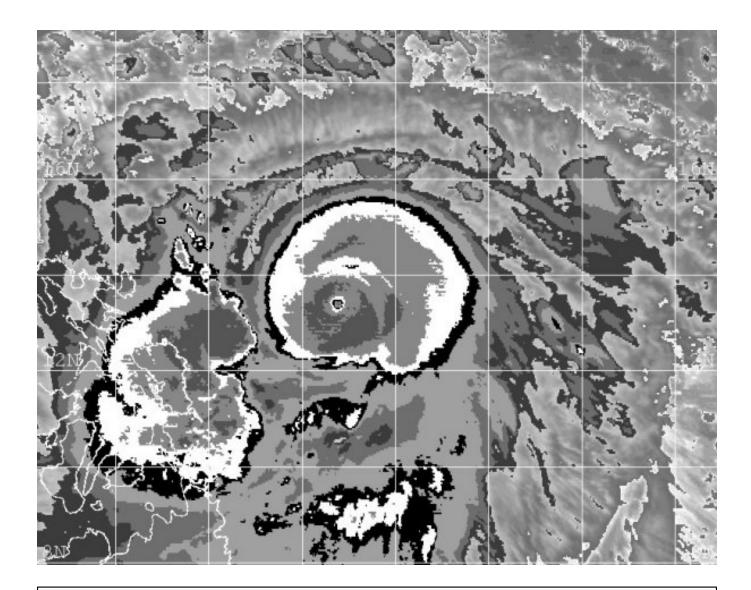


Figure 1-09W-1. 202025Z July 2003 GOES-9 enhanced infrared imagery of STY 09W (Imbudo), the small eye was located 155 nm east of Luzon, Philippines in the south china sea at its peak intensity of 130 knots.

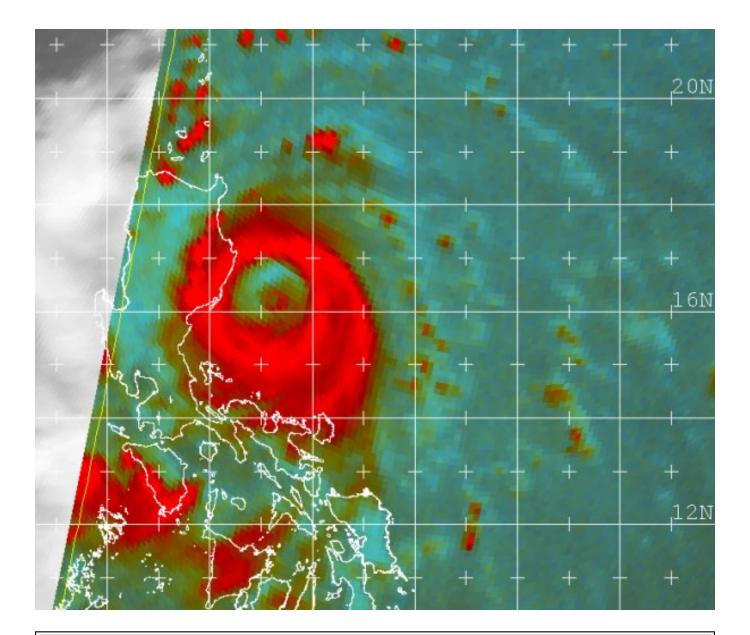


Figure 1-09W-2. 212206Z July 2003 GOES-9 SSM/I color composite imagery of STY 09W (Imbudo), the system was undergoing a concentric eyewall cycle. Located 440 nm east southeast of Luzon, Philippines at its peak intensity of 130 knots.

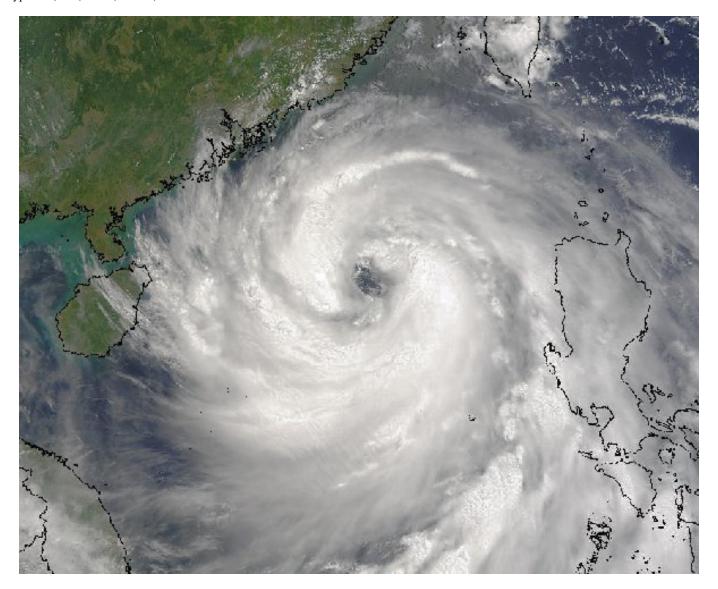
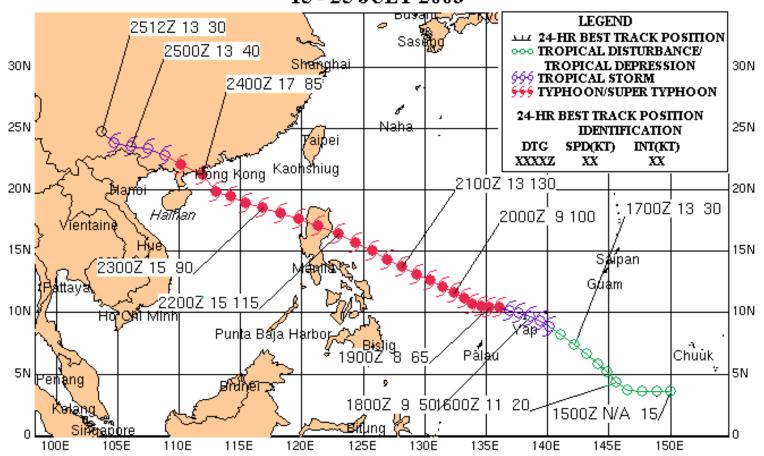
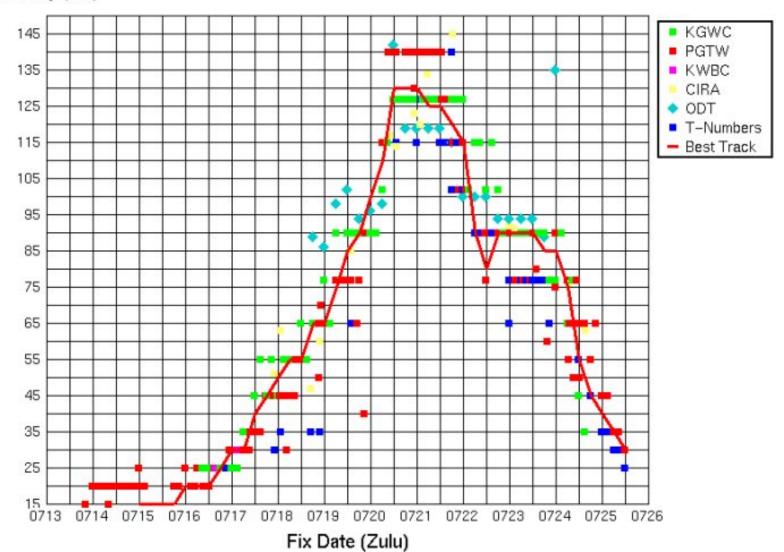


Figure 1-09W-3. 230255Z July 2003 MODIS true-color image of STY 09W (Imbudo), located in the South China Sea, with an intensity of 90 knots.

### SUPER TYPHOON 09W (IMBUDO) 15 - 25 JULY 2003



## Time Intensity for 09W



## Super Typhoon (STY) 09W (Imbudo)\*



First Poor : 0600Z 14Jul 03

First Fair: 0600Z 15 Jul 03

First TCFA: 0930Z 16 Jul 03

First Warning: 1800Z 16 Jul 03

Last Warning: 1200Z 24 Jul 03

Max Intensity: 130 kts, gusts to 160 kts

Landfall: Yangjiang, China

Total Warnings: 32

Remarks:

1) Super Typhoon (STY) 09W was initially detected and monitored as an area of heavy convection very near Chuuk on 13 July 2003. Subsequently, another area of convection developed southwest of Chuuk around 15 July. For the next 48 hours this second area increased in organization and a first warning was issued by 1800Z on 16 July. The cyclone began to rapidly organize and track northwest along the southwestern periphery of the mid-level steering ridge. Favorable upper tropospheric synoptic flow and warm sea temperatures allowed for a steady rate of intensification slightly greater than climatological. A period of rapid development caused by an increase in equatorward outflow and increased outflow towards a TUTT cell to the northeast occurred from 0000Z on 19 July to 1200Z on 20 July resulted in an intensity increase of 2.5 Dvorak T-Numbers in just 36 hours.

The system then tracked northwest over Luzon, making landfall near 0300Z on 22 July with an estimated intensity of 110 knots and weakened only slightly over central Luzon. After emerging into the South China Sea, STY 09W tracked west-northwest at a rapid 15 knots and reintensified to 90 knots. The cyclone made landfall for a second time on the coast of China at approximately 0000Z on 24 July with an intensity of 85 knots. STY 09W then weakened over land and dissipated within 24 hours.

2) International news agencies reported 21 persons killed in the Philippines and as many as 20 casualties were reported in southern China. In the Philippines, crop damages were estimated at \$37 million. In Southern China, reports indicated that several small coastal reservoirs were damaged, many homes damaged or destroyed and significant losses in livestock experienced in some locations.

\*Named by WMO Designated RSMC

### Statistics for JTWC on STY09W WRN BEST TRACK POSITION ERRORS WIND ERRORS DTG NO. LAT LONG wind 00 12 24 36 120 00 12 24 36 48 72 96 120 48 72 96 03071500 3.6N 150.0E 15 03071506 3.6N 148.9E 15 03071512 3.6N 147.7E 15 03071518 3.7N 146.5E 15 03071600 4.3N 145.6E 20 03071606 5.1N 144.9E 20 03071612 5.8N 144.1E 20 03071618 143.2E 6.6N 25 33 | 73 | 113 | 161 | 205 | 253 0 5 -5 0 5 -5 03071700 7.4N 142.2E 30 48 101 148 173 204 0 0 5 0 10 15 03071706 3 8.2N 141.1E 30 16 34 95 148 175 200 0 -5 -5 -5 -5 25 03071712 4 8.8N 140.2E 40 21 36 90 129 149 188 278 488 0 0 5 5 -5 15 35 30 03071718 5 9.3N 139.4E 45 5 48 77 118 | 128 | 183 | 347 | 503 | 0 0 0 0 -5 5 35 25 03071800 138.6E 31 42 70 9.7N 50 88 72 129 253 406 0 5 5 -5 15 40 20 9.9N 137.7E 37 12 51 03071806 53 51 135 231 336 0 0 5 55 0 10 25 30 03071812 10.1N 136.9E 15 5 55 8 30 43 47 82 174 299 385 0 0 10 15 40 30 225 337 390 0 03071818 9 10.4N 136.1E 22 17 24 65 8 71 -5 25 40 15 30 40 15 10.4N 135.3E 03071900 10 8 12 39 105 265 372 434 0 25 20 65 8 -5 15 25 50 40 03071906 11 10.5N 134.6E 13 6 102 213 281 389 0 75 39 30 30 30 40 25 10 25 10.7N 133.9E 03071912 12 85 11 17 18 60 117 234 296 361 30 | 5 35 10 20 45 35 25 03071918 13 11.1N 133.2E 21 38 69 103 | 152 | 280 | 329 | 380 90 25 | 30 45 10 20 35 20 10 03072000 14 11.6N 132.4E 100 13 41 82 112 168 304 314 402 10 10 30 20 -5 10 25 15 03072006 15 12.1N 131.5E 110 0 30 75 110 173 271 316 501 5 10 20 45 35 -5 -10 133 201 265 309 480 0 03072012 16 12.6N 130.5E 130 13 45 83 15 20 30 55 30 5 -10

15 20 40 25 35 15

0

03072018

17

13.1N 129.4E

130

|13|38|78

142 192 263 331

| 03072100 | 18 | 13.7N | 128.2E  | 130 | 5  | 23 | 75  | 151 | 218 | 259 | 374 |     | 0  | 5       | 0       | 20      | -<br>10 | 0       | 15      |    |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|----|
| 03072106 | 19 | 14.3N | 127.0E  | 125 | 8  | 37 | 102 | 152 | 205 | 258 | 310 |     | 5  | 10      | 35      | 10      | 10      | 5       | -<br>15 |    |
| 03072112 | 20 | 15.0N | 125.8E  | 125 | 0  | 29 | 87  | 143 | 179 | 238 | 266 |     | 5  | 15      | 20      | 10      | 20      | 5       | -<br>10 |    |
| 03072118 | 21 | 15.7N | 124.4E  | 120 | 5  | 42 | 92  | 149 | 181 | 249 |     |     | 10 | 30      | 0       | 15      | 5       | -<br>15 |         |    |
| 03072200 | 22 | 16.4N | 123.0E  | 115 | 5  | 46 | 100 | 128 | 137 | 239 |     |     | 15 | 10      | 15      | 5       | 0       | -<br>10 |         |    |
| 03072206 | 23 | 17.0N | 121.3E  | 90  | 16 | 53 | 88  | 107 | 139 | 306 |     |     | 0  | 15      | 5       | 0       | -<br>10 | -5      |         |    |
| 03072212 | 24 | 17.6N | 119.8E  | 80  | 8  | 54 | 83  | 75  | 155 | 295 |     |     | 0  | 0       | -<br>10 | -<br>25 | -<br>25 | -5      |         |    |
| 03072218 | 25 | 18.1N | 118.3E  | 90  | 20 | 50 | 74  | 76  | 130 |     |     |     | 0  | 5       | 15      | -<br>20 | -<br>10 |         |         |    |
| 03072300 | 26 | 18.5N | 116.8E  | 90  | 16 | 42 | 36  | 70  | 147 |     |     |     | 0  | 5       | -<br>10 | -<br>15 | -<br>20 |         |         |    |
| 03072306 | 27 | 18.9N | 115.4E  | 90  | 5  | 31 | 18  | 53  |     |     |     |     | 0  | -5      | -<br>30 | -<br>20 |         |         |         |    |
| 03072312 | 28 | 19.4N | 114.2E  | 90  | 13 | 25 | 37  | 81  |     |     |     |     | -5 | -<br>10 | -<br>20 | -<br>20 |         |         |         |    |
| 03072318 | 29 | 19.8N | 113.0E  | 85  | 8  | 85 | 81  | 100 |     |     |     |     | 5  | 10      | 0       | -<br>15 |         |         |         |    |
| 03072400 | 30 | 21.2N | 111.9E  | 85  | 6  | 56 | 89  | 101 |     |     |     |     | 5  | -5      | -5      | -<br>10 |         |         |         |    |
| 03072406 | 31 | 22.0N | 110.2E  | 75  | 5  | 17 | 50  |     |     |     |     |     | 5  | -5      | -5      |         |         |         |         |    |
| 03072412 | 32 | 22.8N | 108.9E  | 55  | 12 | 79 |     |     |     |     |     |     | 0  | -5      |         |         |         |         |         |    |
| 03072418 |    | 23.3N | 107.5E  | 45  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |    |
| 03072500 |    | 23.5N | 106.1E  | 40  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |    |
| 03072506 |    | 23.8N | 104.7E  | 35  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |    |
| 03072512 |    | 24.7N | 103.7E  | 30  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |    |
|          |    |       | AVERAGE |     | 12 | 39 | 67  | 101 | 146 | 235 | 308 | 420 | 3  | 9       | 13      | 17      | 19      | 20      | 18      | 19 |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | 1  | 0       | -4      | -6      | -5      | -3      | 6       | 16 |
|          |    |       | # CASES |     | 32 | 32 | 31  | 30  | 26  | 24  | 17  | 13  | 32 | 32      | 31      | 30      | 26      | 24      | 17      | 13 |

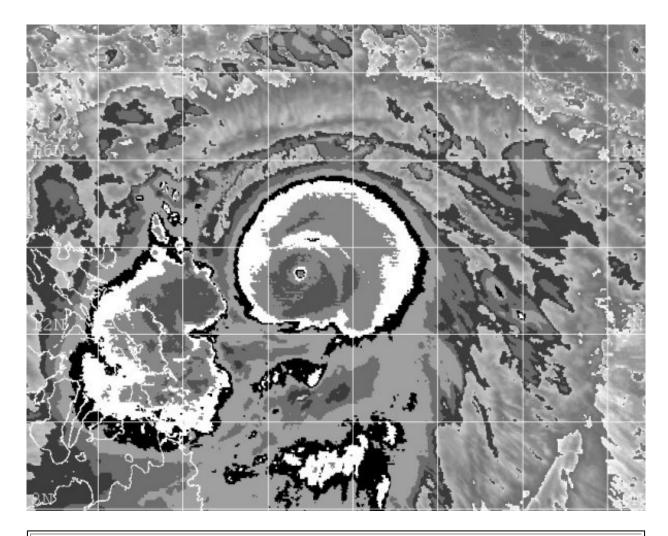


Figure 1-09W-1. 202025Z July 2003 GOES-9 enhanced infrared imagery of STY 09W (Imbudo), the small eye was located 155 nm east of Luzon, Philippines in the south china sea at its peak intensity of 130 knots.

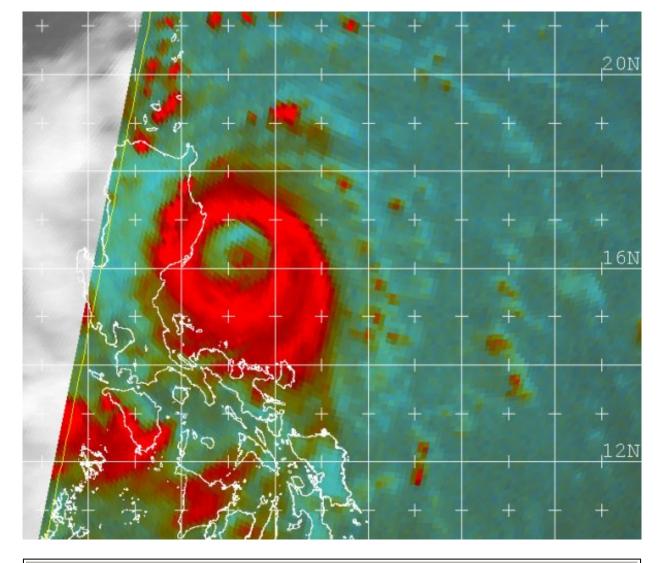


Figure 1-09W-2. 212206Z July 2003 GOES-9 SSM/I color composite imagery of STY 09W (Imbudo), the system was undergoing a concentric eyewall cycle. Located 440 nm east southeast of Luzon, Philippines at its peak intensity of 130 knots.

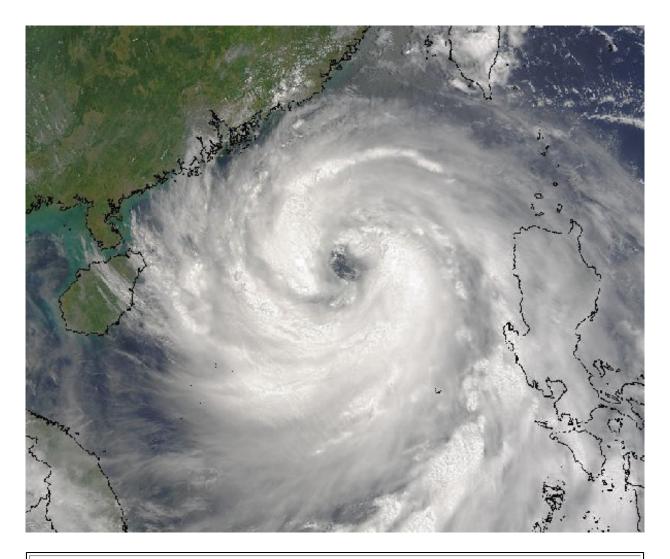
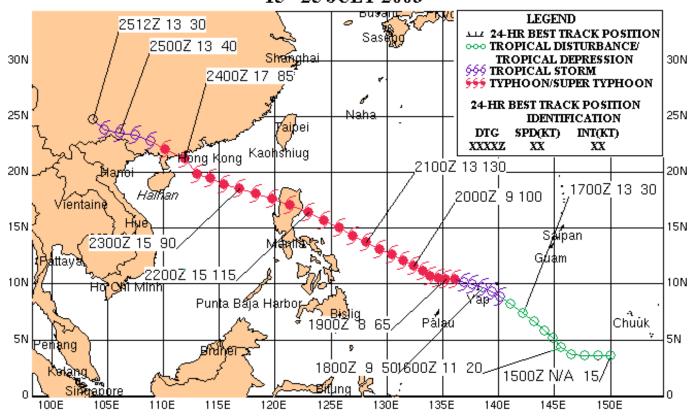
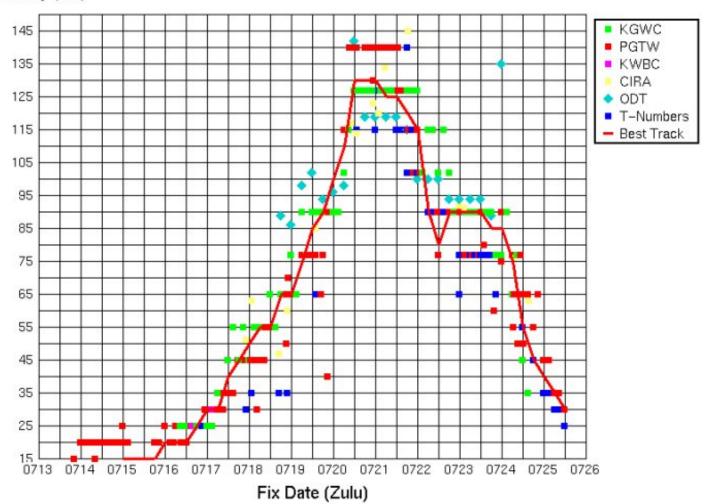


Figure 1-09W-3. 230255Z July 2003 MODIS true-color image of STY 09W (Imbudo), located in the South China Sea, with an intensity of 90 knots.

#### SUPER TYPHOON 09W (IMBUDO) 15 - 25 JULY 2003



# Time Intensity for 09W



# Typhoon (TY) 10W (Morakot)\*



First Poor: N/A

First Fair: N/A

First TCFA: 1400Z 31 Jul 03

First Warning: 1200Z 01 Aug 03

Last Warning: 0000Z 05 Aug 03, Dissipated

Max Intensity: 65 kts, gusts to 80 kts

Landfall: T'aitung, Taiwan & Quanzhou, China

Total Warnings: 15

Remarks:

1) Typhoon (TY) 10W was initially designated as a tropical disturbance in the Philippine Sea on 30 July, 2003, with a first warning issued at 1200Z on 31 July. The system was classified as a tropical depression as it began to organize and track northwest along the western periphery of the mid-level steering ridge northeast of the system. Outflow associated with a col in the upper ridge axis permitted the cyclone to reach marginal typhoon strength just prior to landfall, at approximately 1500Z on 03 August, on the southeast coast of Taiwan.

TY 10W weakened slightly before emerging in the Taiwan Strait near T'ainan, at approximately 1800Z on 03 Aug. The cyclone then tracked west-northwestward under the influence of the building mid-level ridge to the east until making landfall for a second time, near Quanzhou, China, at approximately 1000Z on 4 Aug with an estimated intensity of 55 knots. TY 10W dissipated in less than 12 hours.

2) Taiwan news agencies reported torrential rains and damaging mudslides but no fatalities. No fatality or significant damage reports were received for the Quanzhou region.

\*Named by WMO designated RSMC

|          |     |       | ,       | Statis | tic | s fo | or JT | ſWC | on <sup>*</sup> | TY 1 | 0W | '   |    |      |     |     |          |    |    |     |
|----------|-----|-------|---------|--------|-----|------|-------|-----|-----------------|------|----|-----|----|------|-----|-----|----------|----|----|-----|
|          |     |       |         |        |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
|          | WRN | BEST  | ΓRACK   |        | PC  | SIT  | ION   | ERR | ORS             |      |    |     | WI | ND E | ERR | ORS | <u> </u> |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind   | 00  | 12   | 24    | 36  | 48              | 72   | 96 | 120 | 00 | 12   | 24  | 36  | 48       | 72 | 96 | 120 |
| 03073018 |     | 11.8N | 130.4E  | 20     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03073100 |     | 12.8N | 129.3E  | 20     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03073106 |     | 13.9N | 128.1E  | 20     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03073112 |     | 14.9N | 127.0E  | 20     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03073118 |     | 15.6N | 126.5E  | 20     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03080100 |     | 16.1N | 126.2E  | 25     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03080106 |     | 16.5N | 126.0E  | 25     |     |      |       |     |                 |      |    |     |    |      |     |     |          |    |    |     |
| 03080112 | 1   | 16.9N | 125.9E  | 30     | 29  | 53   | 78    | 92  | 144             | 240  |    |     | 0  | 0    | 0   | 0   | -10      | 5  |    |     |
| 03080118 | 2   | 17.4N | 125.8E  | 35     | 30  | 85   | 148   | 167 | 147             | 194  |    |     | -5 | -5   | 5   | -10 | 5        | 35 |    |     |
| 03080200 | 3   | 18.3N | 125.6E  | 35     | 8   | 58   | 113   | 105 | 102             | 177  |    |     | 0  | 0    | 5   | 0   | 15       | 10 |    |     |
| 03080206 | 4   | 18.9N | 124.9E  | 45     | 11  | 50   | 75    | 66  | 102             |      |    |     | 0  | 10   | 0   | 15  | -5       |    |    |     |
| 03080212 | 5   | 19.6N | 124.1E  | 45     | 26  | 64   | 77    | 86  | 111             |      |    |     | 0  | 5    | 0   | 15  | 5        |    |    |     |
| 03080218 | 6   | 20.4N | 123.2E  | 45     | 8   | 21   | 11    | 28  | 19              |      |    |     | 0  | -10  | -5  | -5  | 5        |    |    |     |
| 03080300 | 7   | 20.7N | 122.1E  | 50     | 8   | 46   | 33    | 21  | 12              |      |    |     | -5 | -15  | -10 | 0   | 20       |    |    |     |
| 03080306 | 8   | 21.4N | 121.4E  | 65     | 12  | 71   | 80    | 62  |                 |      |    |     | 0  | 5    | -5  | 10  |          |    |    |     |
| 03080312 | 9   | 22.4N | 121.1E  | 65     | 30  | 24   | 48    | 32  |                 |      |    |     | 0  | 5    | 0   | 15  |          |    |    |     |
| 03080318 | 10  | 22.8N | 120.5E  | 60     | 21  | 28   | 37    |     |                 |      |    |     | 5  | 5    | 15  |     |          |    |    |     |
| 03080400 | 11  | 23.3N | 119.7E  | 60     | 24  | 53   | 37    |     |                 |      |    |     | 5  | 0    | 10  |     |          |    |    |     |
| 03080406 | 12  | 24.1N | 119.1E  | 60     | 20  | 16   |       |     |                 |      |    |     | 5  | 5    |     |     |          |    |    |     |
| 03080412 | 13  | 24.8N | 118.4E  | 55     | 10  | 18   |       |     |                 |      |    |     | 0  | 15   |     |     |          |    |    |     |
| 03080418 | 14  | 25.2N | 117.9E  | 35     | 13  |      |       |     |                 |      |    |     | -5 |      |     |     |          |    |    |     |
| 03080500 | 15  | 25.5N | 117.4E  | 30     | 20  |      |       |     |                 |      |    |     | -5 |      |     |     |          |    |    |     |
|          |     |       | AVERAGE |        | 18  | 45   | 67    | 73  | 91              | 204  |    |     | 2  | 6    | 5   | 8   | 9        | 17 |    |     |
|          |     |       | BIAS    |        |     |      |       |     |                 |      |    |     | 0  | 2    | 1   | 4   | 5        | 17 |    |     |
|          |     |       | # CASES |        | 15  | 13   | 11    | 9   | 7               | 3    |    |     | 15 | 13   | 11  | 9   | 7        | 3  |    |     |

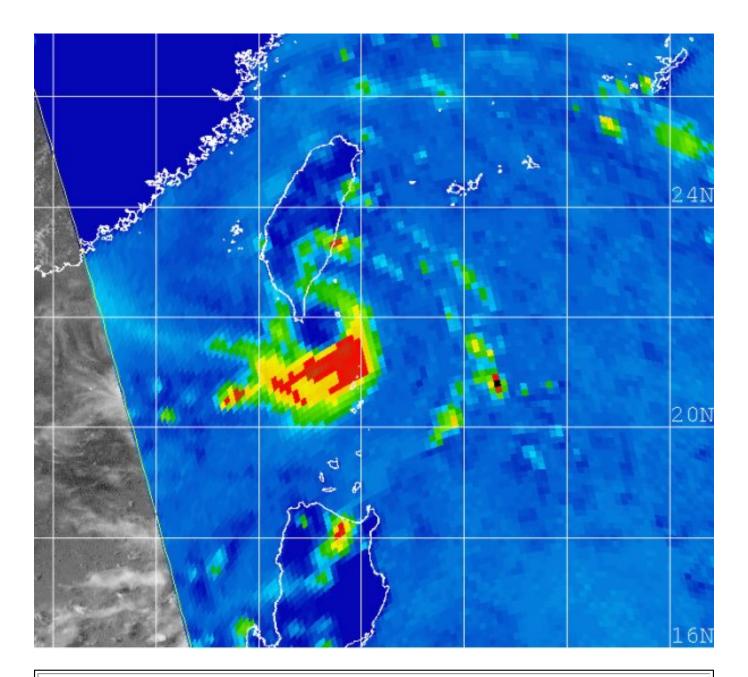
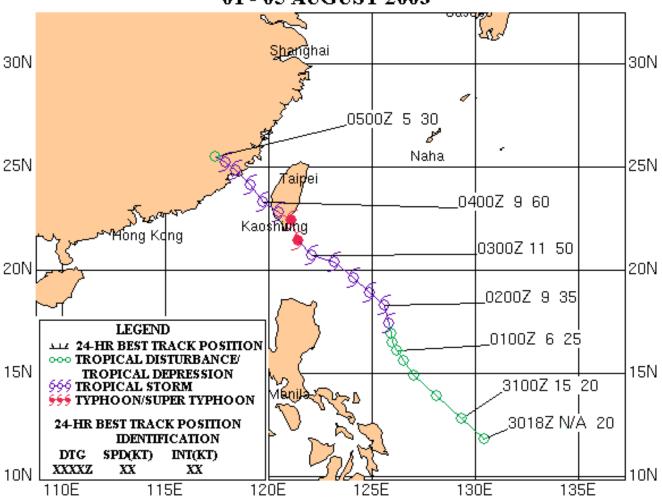
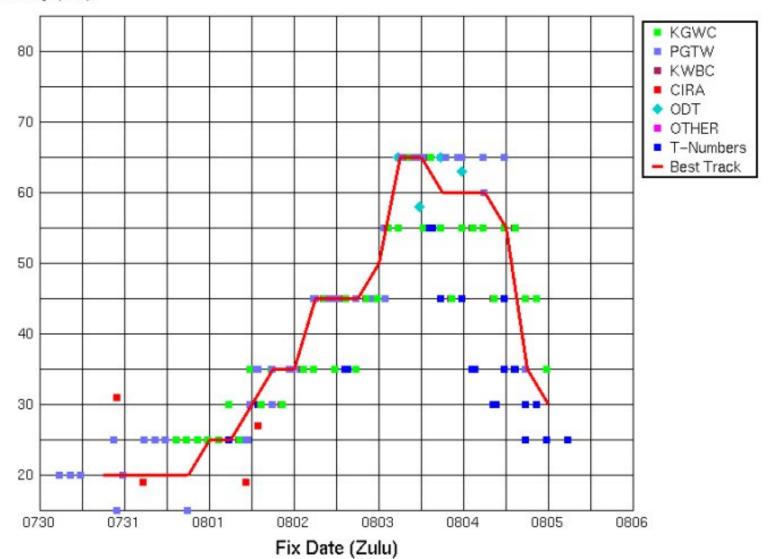


Figure 1-10W-1. 030952Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 10W (Morakot), the large eye was located on the southern coast of Taiwan at its peak intensity of 65 knots.

#### TYPHOON 10W (MORAKOT) 01 - 05 AUGUST 2003



# Time Intensity for 10W



# Typhoon (TY) 10W (Morakot)



First Poor: N/A

First Fair: N/A

First TCFA: 1400Z 31 Jul 03

First Warning: 1200Z 01 Aug 03

Last Warning: 0000Z 05 Aug 03, Dissipated

Max Intensity: 65 kts, gusts to 80 kts

Landfall: T'aitung, Taiwan & Quanzhou, China

Total Warnings: 15

Remarks:

1) Typhoon (TY) 10W was initially designated as a tropical disturbance in the Philippine Sea on 30 July, 2003, with a first warning being issued at 1200Z on 31 July. The system was classified as a tropical depression as it began to organize and track northwest along western periphery of the mid-level steering ridge northeast of the system. Outflow associated with a col in the upper ridge axis permitted the cyclone to reach marginal typhoon strength just prior to landfall, at approximately 1500Z on 03 August, on the southeast coast of Taiwan.

Subsequently, TY 10W weakened slightly before emerging in the Taiwan Strait, near T'ainan, at approximately 1800Z on 03 Aug. The cyclone then tracked west-northwestward under the influence of the building mid-level ridge to the east until making landfall for a second time, near Quanzhou, China, at approximately 1000Z on 4 Aug with an estimated intensity of 55 knots and dissipated in less than 12 hours.

2) Taiwan news agencies reported torrential rains and damaging mudslides but no fatalities. No fatality or significant damage reports were received for the Quanzhou region.

|          |     |       |         | Statis | stic | s fo | or J1 | WC  | on ' | TY 1 | 0W | 1   |    |      |     |     |     |    |    |     |
|----------|-----|-------|---------|--------|------|------|-------|-----|------|------|----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |        |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |        | PC   | SIT  | ION   | ERR | ORS  | )    |    |     | WI | ND E | ERR | ORS | 3   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind   | 00   | 12   | 24    | 36  | 48   | 72   | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03073018 |     | 11.8N | 130.4E  | 20     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03073100 |     | 12.8N | 129.3E  | 20     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03073106 |     | 13.9N | 128.1E  | 20     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03073112 |     | 14.9N | 127.0E  | 20     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03073118 |     | 15.6N | 126.5E  | 20     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03080100 |     | 16.1N | 126.2E  | 25     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03080106 |     | 16.5N | 126.0E  | 25     |      |      |       |     |      |      |    |     |    |      |     |     |     |    |    |     |
| 03080112 | 1   | 16.9N | 125.9E  | 30     | 29   | 53   | 78    | 92  | 144  | 240  |    |     | 0  | 0    | 0   | 0   | -10 | 5  |    |     |
| 03080118 | 2   | 17.4N | 125.8E  | 35     | 30   | 85   | 148   | 167 | 147  | 194  |    |     | -5 | -5   | 5   | -10 | 5   | 35 |    |     |
| 03080200 | 3   | 18.3N | 125.6E  | 35     | 8    | 58   | 113   | 105 | 102  | 177  |    |     | 0  | 0    | 5   | 0   | 15  | 10 |    |     |
| 03080206 | 4   | 18.9N | 124.9E  | 45     | 11   | 50   | 75    | 66  | 102  |      |    |     | 0  | 10   | 0   | 15  | -5  |    |    |     |
| 03080212 | 5   | 19.6N | 124.1E  | 45     | 26   | 64   | 77    | 86  | 111  |      |    |     | 0  | 5    | 0   | 15  | 5   |    |    |     |
| 03080218 | 6   | 20.4N | 123.2E  | 45     | 8    | 21   | 11    | 28  | 19   |      |    |     | 0  | -10  | -5  | -5  | 5   |    |    |     |
| 03080300 | 7   | 20.7N | 122.1E  | 50     | 8    | 46   | 33    | 21  | 12   |      |    |     | -5 | -15  | -10 | 0   | 20  |    |    |     |
| 03080306 | 8   | 21.4N | 121.4E  | 65     | 12   | 71   | 80    | 62  |      |      |    |     | 0  | 5    | -5  | 10  |     |    |    |     |
| 03080312 | 9   | 22.4N | 121.1E  | 65     | 30   | 24   | 48    | 32  |      |      |    |     | 0  | 5    | 0   | 15  |     |    |    |     |
| 03080318 | 10  | 22.8N | 120.5E  | 60     | 21   | 28   | 37    |     |      |      |    |     | 5  | 5    | 15  |     |     |    |    |     |
| 03080400 | 11  | 23.3N | 119.7E  | 60     | 24   | 53   | 37    |     |      |      |    |     | 5  | 0    | 10  |     |     |    |    |     |
| 03080406 | 12  | 24.1N | 119.1E  | 60     | 20   | 16   |       |     |      |      |    |     | 5  | 5    |     |     |     |    |    |     |
| 03080412 | 13  | 24.8N | 118.4E  | 55     | 10   | 18   |       |     |      |      |    |     | 0  | 15   |     |     |     |    |    |     |
| 03080418 | 14  | 25.2N | 117.9E  | 35     | 13   |      |       |     |      |      |    |     | -5 |      |     |     |     |    |    |     |
| 03080500 | 15  | 25.5N | 117.4E  | 30     | 20   |      |       |     |      |      |    |     | -5 |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |        | 18   | 45   | 67    | 73  | 91   | 204  |    |     | 2  | 6    | 5   | 8   | 9   | 17 |    |     |
|          |     |       | BIAS    |        |      |      |       |     |      |      |    |     | 0  | 2    | 1   | 4   | 5   | 17 |    |     |

15 13 11 9 7 3

15 13 11 9 7

3

# CASES

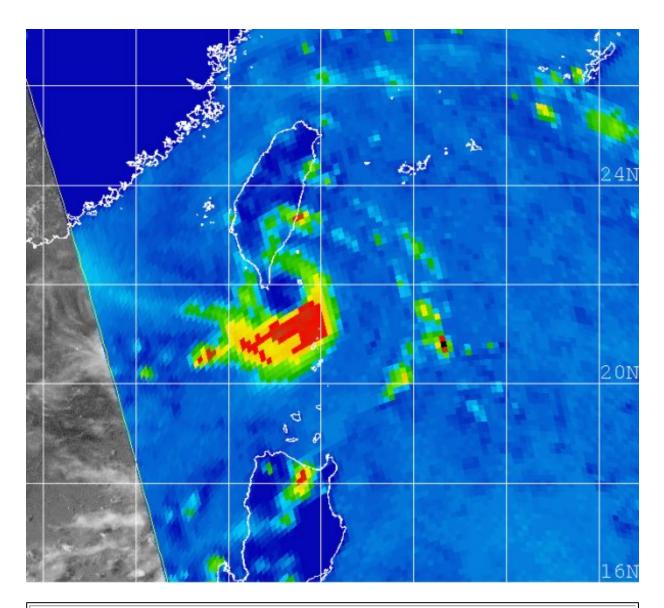
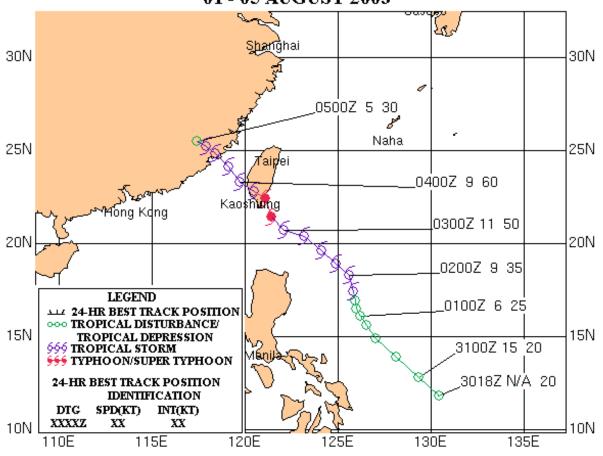
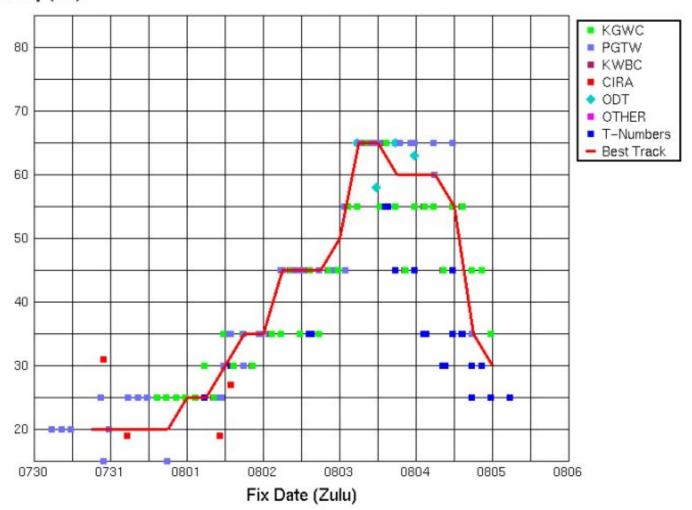


Figure 1-10W-1. 030952Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 10W (Morakot), the large eye was located on the southern coast of Taiwan at its peak intensity of 65 knots.

#### TYPHOON 10W (MORAKOT) 01 - 05 AUGUST 2003



# Time Intensity for 10W



# Typhoon (TY) 11W (Etau)\*



First Poor: 0600Z 30 Jul 03

First Fair: 2330Z 31 Jul 03

First TCFA: 2230Z 01 Aug 03

First Warning: 0000Z 02 Aug 03

Last Warning: 1800Z 09 Aug 03, Extratropical

Max Intensity: 110 kts, gusts to 135 kts

Landfall : Multiple Events

Total Warnings: 28

Remarks:

1) Typhoon (TY) 11W developed approximately 140 nm northwest of Chuuk on 31 July, 2003. The first warning was issued at 0000Z on 02 August. The cyclone remained a tropical depression for the first 24 hours and then rapidly developed at greater than a Dvorak T-number per day over the next 48 hours as a result of the presence of dual outflow channels. In addition to synoptic equatorward outflow, an upper level cyclone to the northeast provided the second enhanced outflow path.

TY 11W tracked steadily northwestward along the subtropical ridge located east of Japan for the first 96 hours. The cyclone then turned poleward and tracked over Naha, Okinawa at 0000Z on August 7 while at peak intensity of 110 knots. Available synoptic reports from Kadena, Okinawa estimated surface winds at 60 knots gusting to 98 knots just prior to eyewall passage. The lowest pressure reported for this cyclone was 949 mb over Naze, Amami O Shima.

TY 11W maintained 110 knot intensity for approximately 18 hours while tracking northeastward along the northwest periphery of the subtropical ridge. After TY 11W tracked over the Ryukus Island chain, it began to slowly weaken as it encountered increasing vertical wind shear, cool air and the mountainous terrain of Shikoku and Honshu. The cyclone transitioned into an extra-tropical cyclone just north of Misawa, Japan and was subsequently finaled.

2) Reports indicated 10 fatalities, 10 injuries and 11 missing persons in Japan resulting from heavy rains and landslides. Other damage reports indicated there were grounded flights, disrupted train

service, and loss of power to 22,500 homes in mainland Japan.

\*Named by WMO Designated RSMC

|          |     |       |        | St   | tati | stics | s for | JTV | VC o | n T | /11V | V   |    |      |     |     |     |     |     |     |
|----------|-----|-------|--------|------|------|-------|-------|-----|------|-----|------|-----|----|------|-----|-----|-----|-----|-----|-----|
|          |     |       |        |      |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
|          | WRN | BEST  | TRACK  |      | РО   | SITI  | ON E  | RRC | RS   |     |      |     | WI | ND E | ERR | ORS | 3   |     |     |     |
| DTG      | NO. | LAT   | LONG   | wind | 00   | 12    | 24    | 36  | 48   | 72  | 96   | 120 | 00 | 12   | 24  | 36  | 48  | 72  | 96  | 120 |
| 03073106 |     | 8.6N  | 150.1E | 15   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03073112 |     | 8.6N  | 149.0E | 15   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03073118 |     | 8.6N  | 148.0E | 15   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080100 |     | 8.6N  | 147.1E | 15   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080106 |     | 8.6N  | 146.3E | 15   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080112 |     | 8.7N  | 145.3E | 20   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080118 |     | 9.1N  | 144.4E | 20   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080200 |     | 9.7N  | 143.5E | 25   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080206 |     | 10.2N | 142.4E | 25   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080212 |     | 10.9N | 141.5E | 25   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080218 |     | 11.6N | 140.7E | 25   |      |       |       |     |      |     |      |     |    |      |     |     |     |     |     |     |
| 03080300 | 1   | 12.4N | 139.9E | 30   | 0    | 8     | 59    | 120 | 120  | 127 |      |     | -5 | -10  | -10 | -5  | -20 | -30 |     |     |
| 03080306 | 2   | 13.2N | 139.1E | 35   | 0    | 24    | 97    | 166 | 207  | 216 | 298  | 377 | 0  | 0    | 0   | 0   | -5  | 5   | -35 | -35 |
| 03080312 | 3   | 14.0N | 138.6E | 45   | 5    | 64    | 150   | 188 | 215  | 219 | 230  | 256 | 0  | 0    | 15  | 0   | 10  | 20  | -5  | -15 |
| 03080318 | 4   | 14.9N | 137.8E | 45   | 18   | 86    | 133   | 178 | 208  | 207 | 327  | 389 | 0  | 15   | 25  | 25  | 25  | 20  | -5  | 5   |
| 03080400 | 5   | 15.7N | 136.6E | 55   | 13   | 81    | 107   | 143 | 169  | 205 | 265  | 320 | 0  | 20   | 15  | 20  | 20  | 10  | -10 | -5  |
| 03080406 | 6   | 16.4N | 135.3E | 55   | 16   | 19    | 70    | 107 | 130  | 144 | 289  | 384 | 0  | 10   | 10  | 10  | 15  | 10  | -40 | 10  |
| 03080412 | 7   | 17.1N | 134.0E | 55   | 0    | 36    | 73    | 75  | 75   | 146 | 255  | 420 | 0  | -10  | 0   | 0   | 10  | 10  | -35 | 5   |
| 03080418 | 8   | 17.7N | 133.2E | 65   | 12   | 37    | 70    | 85  | 93   | 130 | 170  | 87  | 5  | 10   | 15  | 25  | 25  | 5   | -35 | 10  |
| 03080500 | 9   | 18.3N | 132.3E | 80   | 0    | 25    | 33    | 30  | 65   | 61  | 227  | 177 | 5  | 15   | 20  | 35  | 15  | 0   | -20 | 15  |
| 03080506 | 10  | 18.8N | 131.5E | 80   | 0    | 17    | 28    | 44  | 77   | 39  | 200  |     | 5  | 25   | 20  | 30  | 15  | 10  | 5   |     |
| 03080512 | 11  | 19.5N | 130.8E | 85   | 13   | 37    | 45    | 76  | 64   | 63  | 92   |     | 0  | 5    | 25  | 20  | 15  | 10  | 0   |     |
| 03080518 | 12  | 20.6N | 130.0E | 90   | 5    | 21    | 24    | 49  | 37   | 144 |      |     | 0  | 10   | 20  | 15  | -5  | -30 |     |     |
| 03080600 | 13  | 21.7N | 129.3E | 95   | 0    | 13    | 22    | 20  | 19   | 147 |      |     | 0  | 15   | 15  | 5   | -10 | -20 |     |     |

|          |    | ,     |        |     |    | ,   | ,  | ,  |     |     |     |     |    |     |     |     |     |     |     |    |
|----------|----|-------|--------|-----|----|-----|----|----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|----|
| 03080606 | 14 | 22.9N | 128.8E | 95  | 0  | 6   | 16 | 26 | 20  | 228 |     |     | 0  | 10  | 15  | 5   | 5   | -10 |     |    |
| 03080612 | 15 | 24.1N | 128.6E | 95  | 8  | 25  | 24 | 12 | 82  | 211 |     |     | 0  | 0   | 0   | -10 | -15 | -10 |     |    |
| 03080618 | 16 | 25.3N | 128.4E | 100 | 0  | 22  | 16 | 18 | 71  | 105 |     |     | 0  | 5   | 5   | 15  | -5  | 5   |     |    |
| 03080700 | 17 | 26.5N | 128.2E | 110 | 0  | 29  | 32 | 12 | 36  | 147 |     |     | 0  | 5   | 10  | 15  | 0   | 5   |     |    |
| 03080706 | 18 | 27.4N | 128.5E | 110 | 5  | 27  | 35 | 54 | 170 |     |     |     | 0  | 10  | 15  | -20 | -10 |     |     |    |
| 03080712 | 19 | 28.3N | 129.5E | 110 | 5  | 32  | 37 | 43 | 103 |     |     |     | 0  | 0   | -10 | -25 | -5  |     |     |    |
| 03080718 | 20 | 29.3N | 130.8E | 105 | 0  | 32  | 24 | 53 | 89  |     |     |     | 0  | 0   | -10 | -5  | 10  |     |     |    |
| 03080800 | 21 | 30.7N | 132.0E | 100 | 0  | 25  | 51 | 84 | 110 |     |     |     | 0  | 0   | -5  | -5  | 10  |     |     |    |
| 03080806 | 22 | 32.0N | 133.0E | 90  | 5  | 23  | 57 | 42 |     |     |     |     | 0  | 0   | 0   | 5   |     |     |     |    |
| 03080812 | 23 | 33.2N | 134.0E | 90  | 5  | 28  | 20 | 60 |     |     |     |     | 0  | -15 | -10 | 15  |     |     |     |    |
| 03080818 | 24 | 34.4N | 134.9E | 80  | 4  | 43  | 25 |    |     |     |     |     | 0  | 5   | 10  |     |     |     |     |    |
| 03080900 | 25 | 35.5N | 136.2E | 65  | 0  | 37  | 76 |    |     |     |     |     | 0  | 0   | 15  |     |     |     |     |    |
| 03080906 | 26 | 36.8N | 138.3E | 45  | 12 | 44  |    |    |     |     |     |     | 0  | 15  |     |     |     |     |     |    |
| 03080912 | 27 | 38.9N | 140.7E | 45  | 5  | 117 |    |    |     |     |     |     | 0  | 20  |     |     |     |     |     |    |
| 03080918 | 28 | 41.2N | 143.3E | 30  | 7  |     |    |    |     |     |     |     | 0  |     |     |     |     |     |     |    |
| 03081000 |    | 43.6N | 147.1E | 25  |    |     |    |    |     |     |     |     |    |     |     |     |     |     |     |    |
|          |    |       | AVERA  | GE  | 5  | 35  | 53 | 73 | 103 | 149 | 235 | 301 | 1  | 9   | 12  | 13  | 12  | 12  | 19  | 13 |
|          |    |       | BIAS   |     |    |     |    |    |     |     |     |     | 0  | 6   | 8   | 7   | 5   | 1   | -18 | -1 |
|          |    |       | # CAS  | ES  | 28 | 27  | 25 | 23 | 21  | 17  | 10  | 8   | 28 | 27  | 25  | 23  | 21  | 17  | 10  | 8  |

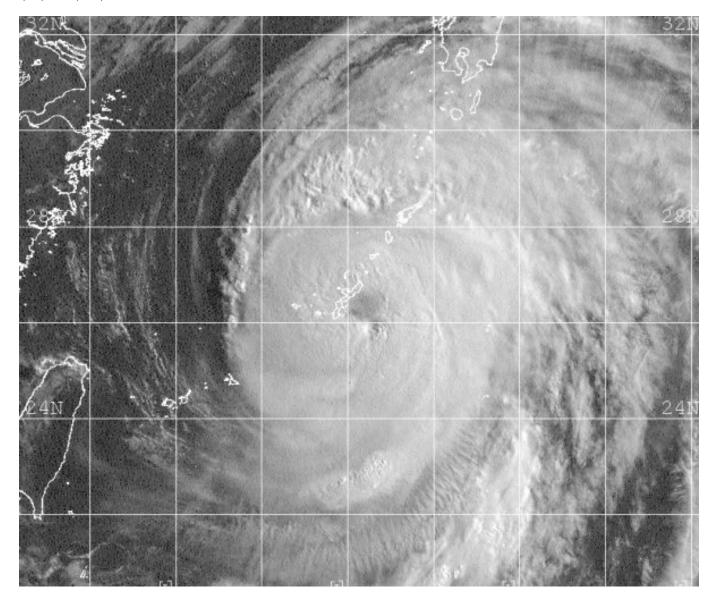


Figure 1-11W-1. 062213Z August 2003 GOES-9 visible imagery of TY 11W (Etau), located 45 nm southeast of Okinawa, Japan at its peak intensity of 110 knots.

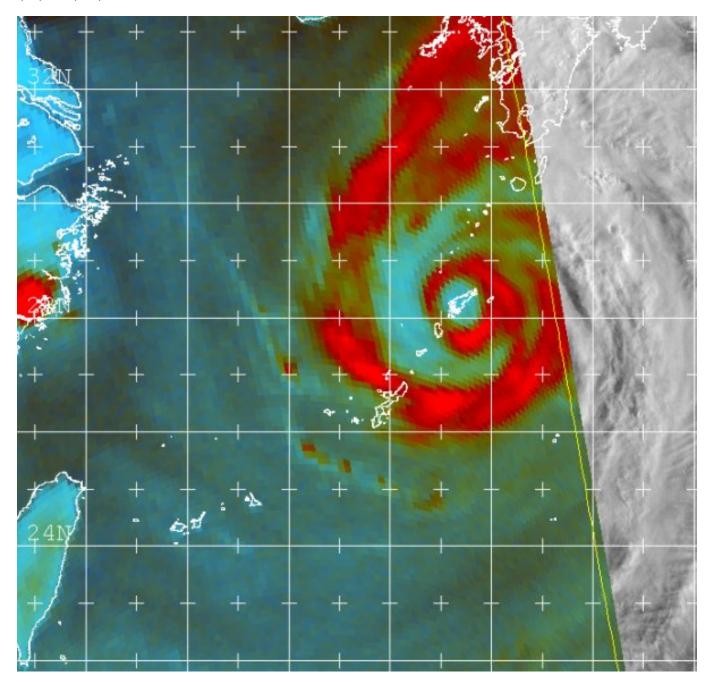
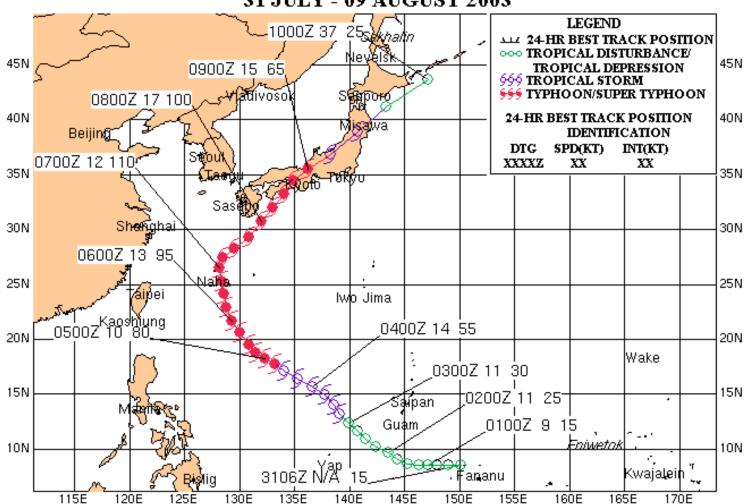


Figure 1-11W-2. 071116Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 11W (Etau), located on over Amami Shima island, Japan at its peak intensity of 110 knots.

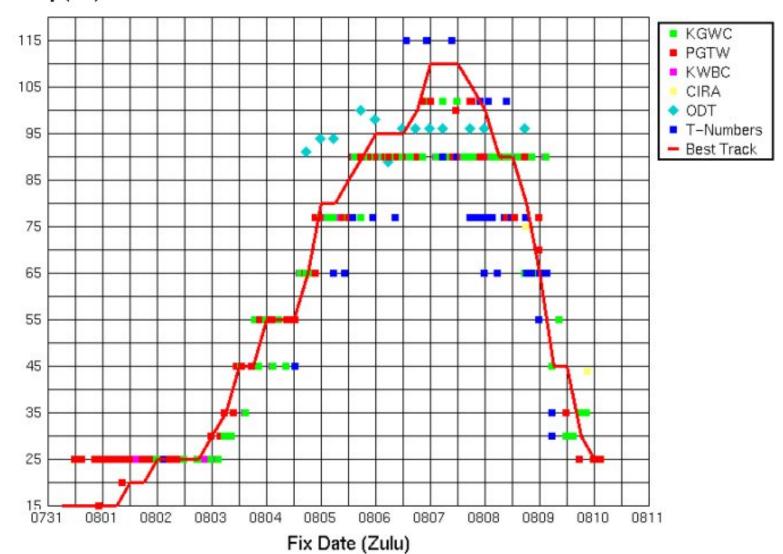


Figure 1-11W-3. 080425Z August 2003 MODIS true-color image of TC 11W (Etau), located off the Japanese coast, with an intensity of 90 knots.

## TYPHOON 11W (ETAU) 31 JULY - 09 AUGUST 2003



# Time Intensity for 11W



# Typhoon (TY) 11W (Etau)\*



First Poor : 0600Z 30 Jul 03

First Fair: 2330Z 31 Jul 03

First TCFA: 2230Z 01 Aug 03

First Warning: 0000Z 02 Aug 03

Last Warning: 1800Z 09 Aug 03, Extratropical

Max Intensity: 110 kts, gusts to 135 kts

Landfall: Multiple Events

Total Warnings: 28

Remarks:

1) Typhoon (TY) 11W initially developed approximately 140 nm northwest of Chuuk on 31 July, 2003. The first warning was issued at 0000Z on 02 August. The cyclone remained a tropical depression for the first 24 hours and then rapidly developed at greater than a Dvorak T-number per day over the next 48 hours as a result of the presence of dual outflow channels. In addition to synoptic equatorward outflow, an upper level cyclone to the northeast provided the second enhanced outflow path.

TY 11W tracked steadily northwestward along the subtropical ridge located east of Japan for the first 96 hours. The cyclone then turned poleward and tracked over Naha, Okinawa at 0000Z on August 7 while at peak intensity of 110 knots. Available synoptic reports from Kadena, Okinawa estimated surface winds at 60 knots gusting to 98 knots just prior to eyewall passage. The lowest pressure reported for this cyclone was 949 mb over Naze, Amami O Shima.

TY 11W maintained 110 knot intensity for approximately 18 hours while tracking northeastward along the northwest periphery of the subtropical ridge. After TY 11W tracked over the Ryukus Island chain, it began to slowly weaken as it encountered increasing vertical wind shear, cool air and the mountainous terrain of Shikoku and Honshu. The cyclone transitioned into an extra-tropical cyclone just north of Misawa, Japan and was subsequently finaled.

2) Reports indicated 10 fatalities, 10 injuries and 11 missing persons in Japan resulting from heavy rains and landslides. Other damage reports indicated there were grounded flights, disrupted train service, and loss of power to 22,500 homes in mainland Japan.

\*Named by WMO Designated RSMC

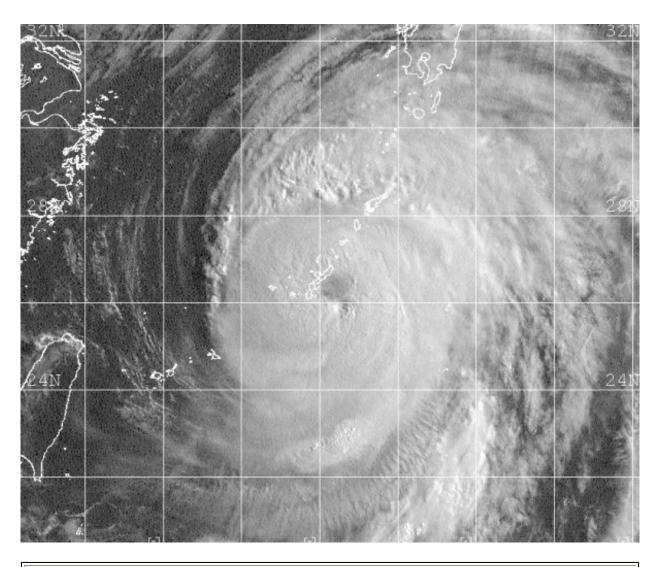


Figure 1-11W-1. 062213Z August 2003 GOES-9 visible imagery of TY 11W (Etau), located 45 nm southeast of Okinawa, Japan at its peak intensity of 110 knots.

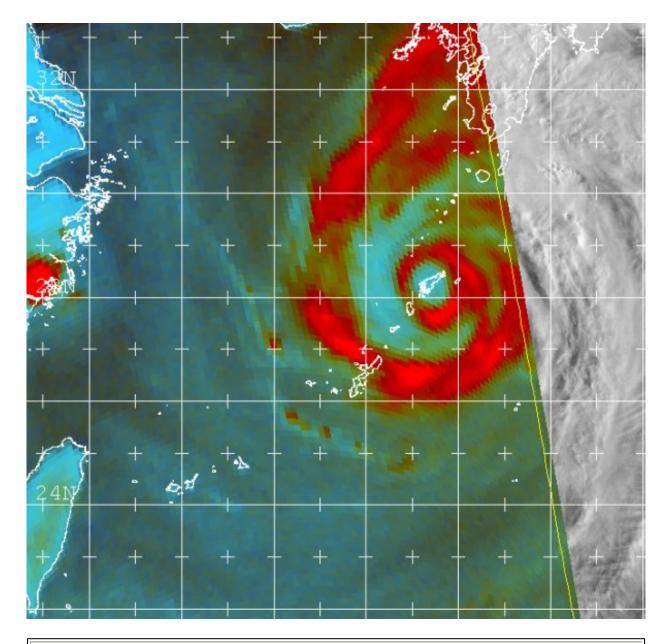


Figure 1-11W-2. 071116Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 11W (Etau), located on over Amami Shima island, Japan at its peak intensity of 110 knots.

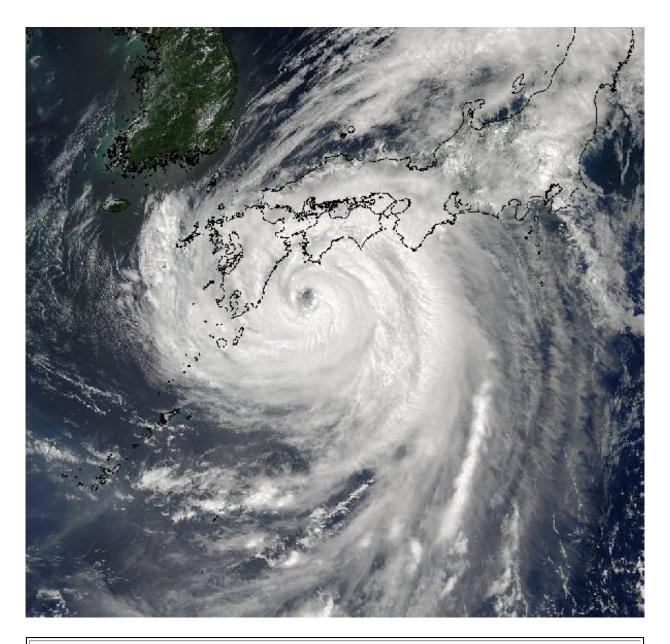
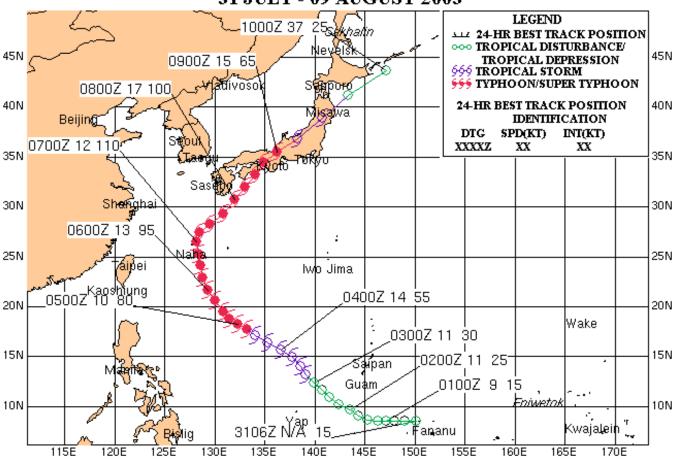
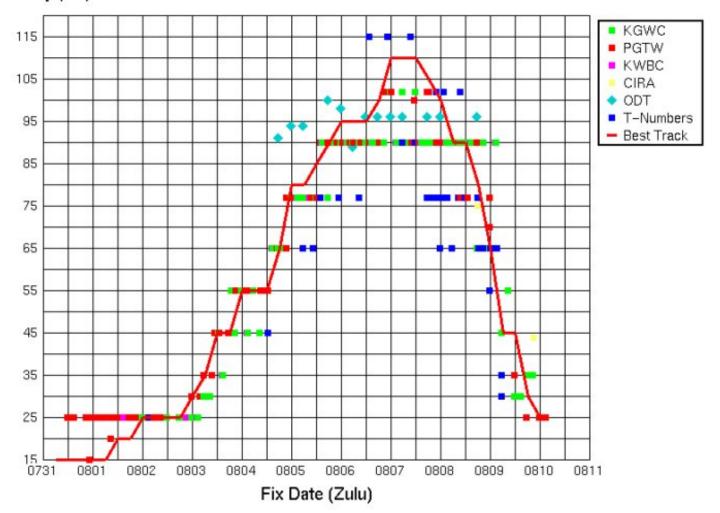


Figure 1-11W-3. 080425Z August 2003 MODIS true-color image of TC 11W (Etau), located off the Japanese coast, with an intensity of 90 knots.

#### TYPHOON 11W (ETAU) 31 JULY - 09 AUGUST 2003



# Time Intensity for 11W



#### Statistics for JTWC on TY11W WRN BEST TRACK POSITION ERRORS WIND ERRORS DTG NO. LAT LONG wind 00 12 120 00 12 36 48 8.6N 150.1E 15 8.6N 149.0E 148.0E 8.6N 8.6N 147.1E 146.3E 8.6N 8.7N 145.3E 144.4E 9.1N 143.5E 9.7N 10.2N 142.4E 25 10.9N 141.5E 25 11.6N 140.7E 25 03080300 1 12.4N 139.9E 120 120 127 -5 -10 -10 -5 -20 | -30 13.2N 139.1E 03080306 2 166 207 216 298 377 0 -35 | -35 -5 03080312 3 14.0N 138.6E 150 188 215 219 230 256 0 15 0 -5 -15 14.9N 137.8E 03080318 4 18 86 133 | 178 | 208 | 207 | 327 | 389 | 0 -5 15.7N 136.6E 107 143 169 205 265 320 0 03080400 | 5 13 81 -10 -5 16.4N 135.3E 130 144 289 384 0 03080406 6 16 19 -40 10 03080412 7 17.1N 134.0E 146 255 420 0 -10 0 -35 5 03080418 8 17.7N 133.2E 12 37 130 170 87 -35 10 18.3N 132.3E 227 177 5 03080500 9 -20 15 03080506 10 18.8N 131.5E 19.5N 130.8E 13 37 20.6N 130.0E -5 -30 21.7N 129.3E -10 -20 22.9N 128.8E -10 24.1N 128.6E -10|-15|-10 25.3N 128.4E -5 26.5N 128.2E 110 0 27.4N 128.5E -20 -10 110 5 28.3N 129.5E 110 | 5 -10|-25|-5 03080718 20 29.3N 130.8E 105 0 0 0 -10 -5 30.7N 132.0E 100 0 -5 -5 03080806 22 32.0N 133.0E 03080812 23 33.2N | 134.0E |-15|-10|15

| 03080818 | 24 | 34.4N | 134.9E | 80 | 4  | 43  | 25 |    |     |     |     |     | 0  | 5  | 10 |    |    |    |     |    |
|----------|----|-------|--------|----|----|-----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|-----|----|
| 03080900 | 25 | 35.5N | 136.2E | 65 | 0  | 37  | 76 |    |     |     |     |     | 0  | 0  | 15 |    |    |    |     |    |
| 03080906 | 26 | 36.8N | 138.3E | 45 | 12 | 44  |    |    |     |     |     |     | 0  | 15 |    |    |    |    |     |    |
| 03080912 | 27 | 38.9N | 140.7E | 45 | 5  | 117 |    |    |     |     |     |     | 0  | 20 |    |    |    |    |     |    |
| 03080918 | 28 | 41.2N | 143.3E | 30 | 7  |     |    |    |     |     |     |     | 0  |    |    |    |    |    |     |    |
| 03081000 |    | 43.6N | 147.1E | 25 |    |     |    |    |     |     |     |     |    |    |    |    |    |    |     |    |
|          |    |       | AVERA  | GE | 5  | 35  | 53 | 73 | 103 | 149 | 235 | 301 | 1  | 9  | 12 | 13 | 12 | 12 | 19  | 13 |
|          |    |       | BIAS   |    |    |     |    |    |     |     |     |     | 0  | 6  | 8  | 7  | 5  | 1  | -18 | -1 |
|          |    |       | # CAS  | ES | 28 | 27  | 25 | 23 | 21  | 17  | 10  | 8   | 28 | 27 | 25 | 23 | 21 | 17 | 10  | 8  |

# Typhoon (TY) 12W (Krovanh)\*



First Poor: N/A

First Fair : 2300Z 13 Aug 03

First TCFA: 2030Z 14 Aug 03

First Warning: 0600Z 15 Aug 03

Last Warning: 0000Z 26 Aug 03; Dissipated over land

Max Intensity: 90 kts, gusts to 110 kts

Landfall: Cam Pha, China

Total Warnings: 40

#### Remarks:

1) Typhoon (TY) 12W developed in the monsoon trough approximately 200 nm east of Chuuk on 13 Aug, 2003 and the first warning was issued at 0600Z on 15 August. This cyclone remained a tropical depression until 20 August as it tracked northwestward in response to flow from a mid-level steering ridge centered to the northeast. TY 12W rapidly developed and moved more southwest over the next 24 hours, achieving typhoon strength by 0600Z on 21 August.

Subsequently, TY 12W tracked westward along the southern periphery of sub-tropical ridge to the north until dissipation. The cyclone achieved peak intensity of 90 knots around 0000Z on 22 August prior to making landfall, for the first time, north of Palanan, Philippines. TY 12W weakened to approximately 70 knots as it tracked across Luzon, then began moving over the South China Sea at approximately 2000Z on 22 August.

TY 12W steadily intensified over the next three days as it moved west-northwestward and passed between Hainan Island and the Luichow Peninsula, China around 0000Z on 25 August. TY 12W reintensified to 90 knots around 0600Z on 25 August while moving through the Gulf of Tonkin, and made landfall at approximately 1500Z on 25 August just north of Cam Pha, Vietnam and dissipated inland.

2) Reports indicated that the Hainan provincial capital city of Haikou lost electricity in many locations. Reports further indicate that five people were hospitalized in Hong Kong and numerous airline flights in the region were delayed.

\*Named by WMO Designated RSMC

|          |     |       |        | Stat | isti | cs fo | or J1 | TWC | on ' | TY1: | 2W  |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|------|------|-------|-------|-----|------|------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |      |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |      | PO   | SITI  | ON E  | RRC | RS   |      |     |     | WI | ND      | ERF     | ROF     | S       |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind | 00   | 12    | 24    | 36  | 48   | 72   | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03081400 |     | 7.0N  | 155.4E | 20   |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03081406 |     | 7.4N  | 154.4E | 20   |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03081412 |     | 8.0N  | 153.4E | 20   |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03081418 |     | 8.7N  | 152.4E | 20   |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03081500 |     | 9.2N  | 151.4E | 20   |      |       |       |     |      |      |     |     |    |         |         |         |         |         |         |     |
| 03081506 | 1   | 9.6N  | 150.7E | 25   | 43   | 71    | 79    | 64  | 49   | 162  |     |     | 0  | 10      | 15      | 20      | 30      | 40      |         |     |
| 03081512 | 2   | 10.0N | 150.1E | 25   | 24   | 42    | 56    | 66  | 102  | 151  |     |     | 0  | 5       | 15      | 20      | 25      | 35      |         |     |
| 03081518 | 3   | 10.4N | 149.5E | 25   | 0    | 0     | 55    | 77  | 123  | 170  | 232 | 286 | 0  | 5       | 15      | 20      | 25      | 35      | 40      | 35  |
| 03081600 | 4   | 10.8N | 148.9E | 25   | 13   | 67    | 101   | 138 | 178  | 233  | 266 | 213 | 0  | 5       | 10      | 15      | 25      | 35      | 30      | -10 |
| 03081606 | 5   | 11.6N | 148.0E | 25   | 0    | 50    | 71    | 94  | 131  | 190  |     |     | 0  | 5       | 10      | 20      | 25      | 30      |         |     |
| 03081612 | 6   | 12.5N | 147.0E | 25   | 24   | 52    | 76    | 104 | 127  | 171  |     |     | 0  | 5       | 10      | 20      | 25      | 30      |         |     |
| 03081618 | 7   | 13.3N | 145.9E | 25   | 34   | 61    | 72    | 104 | 149  | 175  | 256 | 423 | 0  | 5       | 10      | 20      | 25      | 30      | 45      | 35  |
| 03081700 | 8   | 13.7N | 144.8E | 25   | 16   | 13    | 17    | 67  | 70   | 111  | 252 | 376 | 0  | 5       | 15      | 20      | 30      | 40      | -5      | -20 |
| 03081706 | 9   | 14.2N | 143.7E | 25   | 25   | 61    | 87    | 98  | 128  | 120  |     |     | 0  | 0       | 10      | 15      | 20      | 25      |         |     |
| 03081712 | 10  | 15.2N | 142.8E | 25   | 32   | 66    | 50    | 80  | 87   | 138  |     |     | 0  | 0       | 0       | 0       | -5      | -<br>25 |         |     |
| 03081718 | 11  | 16.1N | 141.9E | 25   | 45   | 76    | 98    | 166 | 144  | 149  |     |     | 0  | 0       | 0       | -5      | -5      | -<br>25 |         |     |
| 03081800 | 12  | 17.0N | 140.9E | 25   | 11   | 47    | 64    |     |      |      |     |     | 0  | 0       | -5      |         |         |         |         |     |
| 03081906 | 13  | 20.3N | 135.4E | 30   | 36   | 79    | 125   | 172 | 164  | 179  |     |     | 0  | 5       | 10      | 5       | -<br>10 | -<br>30 |         |     |
| 03081912 | 14  | 20.3N | 134.3E | 30   | 22   | 50    | 126   | 146 | 159  | 173  |     |     | 0  | 5       | 0       | -<br>10 | -<br>10 | -<br>15 |         |     |
| 03081918 | 15  | 20.2N | 133.5E | 30   | 8    | 80    | 162   | 183 | 249  | 297  |     |     | 0  | 0       | -5      | -<br>20 | -<br>25 | -<br>10 |         |     |
| 03082000 | 16  | 20.0N | 132.7E | 30   | 30   | 119   | 157   | 193 | 242  | 326  |     |     | 0  | -<br>10 | -<br>20 | -<br>20 | -<br>40 | -<br>15 |         |     |
| 03082006 | 17  | 19.5N | 132.1E | 35   | 29   | 68    | 72    | 126 | 142  | 202  | 252 | 342 | 0  | -5      | -<br>20 | -<br>25 | -<br>35 | -<br>10 | -<br>15 | -20 |

| 03082012 | 18 | 19.0N | 131.4E  | 45 | 6  | 40 | 46 | 59  | 67  | 231 | 396 | 570 | -5 | -<br>15 | -<br>15 | -<br>35 | -<br>20 | -<br>15 | -<br>20 | -20 |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03082018 | 19 | 18.7N | 130.4E  | 45 | 5  | 28 | 55 | 85  | 145 | 198 | 339 | 569 | 0  | -5      | -5      | -<br>15 | 10      | 10      | -<br>30 | -25 |
| 03082100 | 20 | 18.6N | 129.3E  | 60 | 6  | 19 | 51 | 84  | 158 | 206 | 354 | 582 | 0  | 5       | -<br>10 | 5       | 10      | 5       | -<br>25 | -20 |
| 03082106 | 21 | 18.5N | 128.2E  | 65 | 8  | 49 | 72 | 142 | 173 | 209 | 358 |     | 0  | 0       | -5      | 10      | 10      | 0       | -<br>45 |     |
| 03082112 | 22 | 18.2N | 127.1E  | 65 | 0  | 38 | 59 | 105 | 118 | 157 | 260 |     | 0  | -<br>10 | 0       | 5       | 5       | -<br>10 | -<br>50 |     |
| 03082118 | 23 | 17.8N | 125.9E  | 75 | 8  | 18 | 72 | 77  | 85  | 170 | 396 |     | 0  | -5      | 5       | 5       | 10      | -<br>40 | -<br>45 |     |
| 03082200 | 24 | 17.7N | 124.5E  | 90 | 6  | 8  | 46 | 59  | 61  | 151 | 412 |     | 0  | 0       | 5       | 10      | 10      | -<br>35 | -<br>30 |     |
| 03082206 | 25 | 17.7N | 123.3E  | 90 | 22 | 42 | 42 | 42  | 61  | 185 |     |     | 0  | 5       | 10      | 15      | 5       | -<br>45 |         |     |
| 03082212 | 26 | 17.6N | 122.1E  | 80 | 0  | 60 | 62 | 46  | 62  | 152 |     |     | 0  | 10      | 15      | 10      | 0       | -<br>50 |         |     |
| 03082218 | 27 | 17.1N | 120.6E  | 70 | 12 | 17 | 13 | 18  | 34  | 96  |     |     | 0  | 10      | 15      | 10      | -<br>10 | -5      |         |     |
| 03082300 | 28 | 17.5N | 119.2E  | 70 | 13 | 26 | 24 | 49  | 56  | 148 |     |     | 0  | 10      | 10      | 5       | -5      | -<br>10 |         |     |
| 03082306 | 29 | 17.6N | 117.9E  | 70 | 0  | 0  | 6  | 25  | 54  |     |     |     | 0  | 10      | 10      | -<br>10 | -<br>40 |         |         |     |
| 03082312 | 30 | 17.9N | 116.8E  | 70 | 11 | 27 | 12 | 8   | 19  |     |     |     | 0  | 5       | 0       | -<br>20 | -<br>40 |         |         |     |
| 03082318 | 31 | 18.3N | 115.8E  | 70 | 13 | 29 | 26 | 39  | 58  |     |     |     | 0  | -5      | -<br>20 | -<br>35 | -<br>20 |         |         |     |
| 03082400 | 32 | 18.8N | 114.7E  | 75 | 12 | 34 | 41 | 59  | 96  |     |     |     | 0  | -5      | -<br>10 | -<br>30 | -<br>15 |         |         |     |
| 03082406 | 33 | 19.2N | 113.4E  | 80 | 0  | 12 | 31 | 62  |     |     |     |     | 0  | 0       | -<br>25 | -<br>35 |         |         |         |     |
| 03082412 | 34 | 19.6N | 112.2E  | 85 | 8  | 11 | 21 | 29  |     |     |     |     | 0  | -<br>15 | -<br>40 | -<br>25 |         |         |         |     |
| 03082418 | 35 | 20.0N | 111.1E  | 85 | 6  | 6  | 25 |     |     |     |     |     | 0  | -<br>20 | -<br>15 |         |         |         |         |     |
| 03082500 | 36 | 20.4N | 110.0E  | 80 | 12 | 38 | 84 |     |     |     |     |     | 0  | -<br>25 | -<br>10 |         |         |         |         |     |
| 03082506 | 37 | 20.8N | 108.9E  | 90 | 0  | 29 |    |     |     |     |     |     | 0  | -5      |         |         |         |         |         |     |
| 03082512 | 38 | 21.2N | 107.8E  | 90 | 5  | 13 |    |     |     |     |     |     | 0  | 0       |         |         |         |         |         |     |
|          | 39 |       | 106.7E  | 65 | 11 |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |     |
|          |    |       | 105.2E  | 50 | 16 |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |     |
|          |    |       | AVERAGE |    |    | 41 | 63 | 87  | 113 | 180 | 314 | 420 |    | 6       | 11      | 16      | 18      | 24      | 32      | 23  |

|  |  | BIAS    |    |    |    |    |    |    |    |   | 0  | 0  | 0  | -1 | 0  | -1 | -<br>13 | -6 |
|--|--|---------|----|----|----|----|----|----|----|---|----|----|----|----|----|----|---------|----|
|  |  | # CASES | 40 | 38 | 36 | 33 | 31 | 27 | 12 | 8 | 40 | 38 | 36 | 33 | 31 | 27 | 12      | 8  |

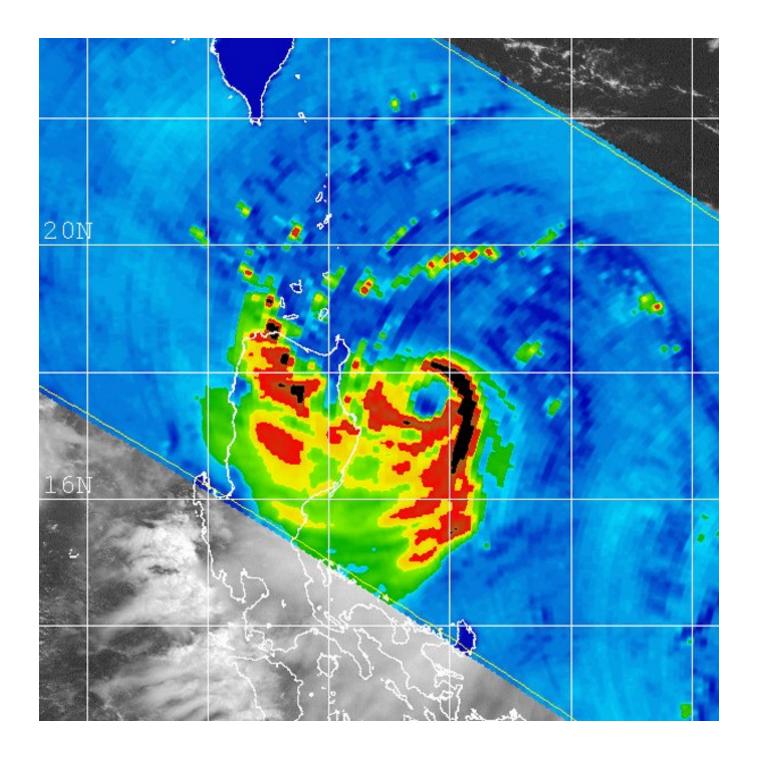


Figure 1-12W-1. 220353Z August 2003 SSMI/GOES-9 visible imagery of TY 12W (Krovanh), located 110 nm east of Luzon, Philippines prior to landfall at its peak intensity of 90 knots.

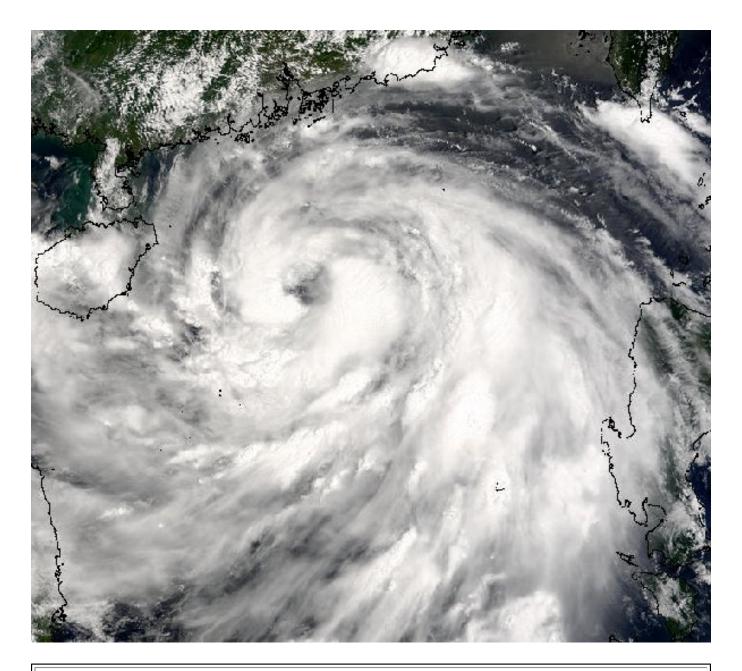
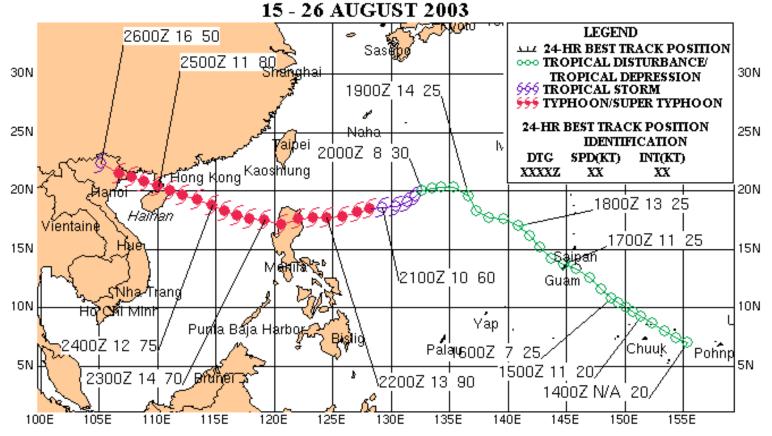
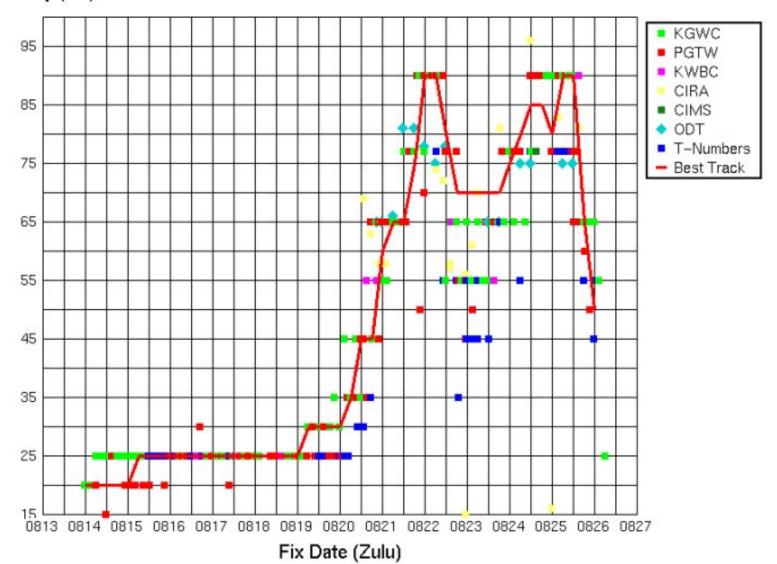


Figure 1-12W-2. 240300Z January 2003 MODIS true-color image of TY 12W (Krovanh), located in the South China Sea, with an intensity of 75 knots.

# TYPHOON 12W (KROVANH)



# Time Intensity for 12W



## Typhoon (TY) 12W (Krovanh)\*



First Poor: N/A

First Fair : 2300Z 13 Aug 03

First TCFA: 2030Z 14 Aug 03

First Warning: 0600Z 15 Aug 03

Last Warning: 0000Z 26 Aug 03; Dissipated over land

Max Intensity: 90 kts, gusts to 110 kts

Landfall: Cam Pha, China

Total Warnings: 40

Remarks:

1) Typhoon (TY) 12W developed in the monsoon trough approximately 200 nm east of Chuuk on 13 Aug, 2003 and the first warning was issued at 0600Z on 15 August. This cyclone remained a tropical depression until 20 August as it tracked northwestward in response to flow from a mid-level steering ridge centered to the northeast. TY 12W rapidly developed and moved more southwest over the next 24 hours, achieving typhoon strength by 0600Z on 21 August.

Subsequently, TY 12W tracked westward along the southern periphery of sub-tropical ridge to the north until dissipation. The cyclone achieved peak intensity of 90 knots around 0000Z on 22 August prior to making landfall, for the first time, north of Palanan, Philippines. TY 12W weakened to approximately 70 knots as it tracked across Luzon, then began moving over the South China Sea at approximately 2000Z on 22 August.

TY 12W steadily intensified over the next three days as it moved west-northwestward and passed between Hainan Island and the Luichow Peninsula, China around 0000Z on 25 August. TY 12W reintensified to 90 knots around 0600Z on 25 August while moving through the Gulf of Tonkin, and made landfall at approximately 1500Z on 25 August just north of Cam Pha, Vietnam and dissipated inland.

2) Reports indicated that the Hainan provincial capital city of Haikou lost electricity in many locations. Reports further indicate that five people were hospitalized in Hong Kong and delays to numerous airline flights in the region.

\*Named by WMO Designated RSMC

|          |     |       |        | Stati | isti | cs fo | or Jī | ΓWC | on  | TY1 | 2W  |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|-------|-------|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |       |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |     |       |        |       |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |       | РО   | SITI  | ON E  | RRC | RS  |     |     |     | WI | ND      | ERF     | ROF     | RS      |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00   | 12    | 24    | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03081400 |     | 7.0N  | 155.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03081406 |     | 7.4N  | 154.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03081412 |     | 8.0N  | 153.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03081418 |     | 8.7N  | 152.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03081500 |     | 9.2N  | 151.4E | 20    |      |       |       |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03081506 | 1   | 9.6N  | 150.7E | 25    | 43   | 71    | 79    | 64  | 49  | 162 |     |     | 0  | 10      | 15      | 20      | 30      | 40      |         |     |
| 03081512 | 2   | 10.0N | 150.1E | 25    | 24   | 42    | 56    | 66  | 102 | 151 |     |     | 0  | 5       | 15      | 20      | 25      | 35      |         |     |
| 03081518 | 3   | 10.4N | 149.5E | 25    | 0    | 0     | 55    | 77  | 123 | 170 | 232 | 286 | 0  | 5       | 15      | 20      | 25      | 35      | 40      | 35  |
| 03081600 | 4   | 10.8N | 148.9E | 25    | 13   | 67    | 101   | 138 | 178 | 233 | 266 | 213 | 0  | 5       | 10      | 15      | 25      | 35      | 30      | -10 |
| 03081606 | 5   | 11.6N | 148.0E | 25    | 0    | 50    | 71    | 94  | 131 | 190 |     |     | 0  | 5       | 10      | 20      | 25      | 30      |         |     |
| 03081612 | 6   | 12.5N | 147.0E | 25    | 24   | 52    | 76    | 104 | 127 | 171 |     |     | 0  | 5       | 10      | 20      | 25      | 30      |         |     |
| 03081618 | 7   | 13.3N | 145.9E | 25    | 34   | 61    | 72    | 104 | 149 | 175 | 256 | 423 | 0  | 5       | 10      | 20      | 25      | 30      | 45      | 35  |
| 03081700 | 8   | 13.7N | 144.8E | 25    | 16   | 13    | 17    | 67  | 70  | 111 | 252 | 376 | 0  | 5       | 15      | 20      | 30      | 40      | -5      | -20 |
| 03081706 | 9   | 14.2N | 143.7E | 25    | 25   | 61    | 87    | 98  | 128 | 120 |     |     | 0  | 0       | 10      | 15      | 20      | 25      |         |     |
| 03081712 | 10  | 15.2N | 142.8E | 25    | 32   | 66    | 50    | 80  | 87  | 138 |     |     | 0  | 0       | 0       | 0       | -5      | -<br>25 |         |     |
| 03081718 | 11  | 16.1N | 141.9E | 25    | 45   | 76    | 98    | 166 | 144 | 149 |     |     | 0  | 0       | 0       | -5      | -5      | -<br>25 |         |     |
| 03081800 | 12  | 17.0N | 140.9E | 25    | 11   | 47    | 64    |     |     |     |     |     | 0  | 0       | -5      |         |         |         |         |     |
| 03081906 | 13  | 20.3N | 135.4E | 30    | 36   | 79    | 125   | 172 | 164 | 179 |     |     | 0  | 5       | 10      | 5       | -<br>10 | -<br>30 |         |     |
| 03081912 | 14  | 20.3N | 134.3E | 30    | 22   | 50    | 126   | 146 | 159 | 173 |     |     | 0  | 5       | 0       | -<br>10 | -<br>10 | -<br>15 |         |     |
| 03081918 | 15  | 20.2N | 133.5E | 30    | 8    | 80    | 162   | 183 | 249 | 297 |     |     | 0  | 0       | -5      | -<br>20 | -<br>25 | -<br>10 |         |     |
| 03082000 | 16  | 20.0N | 132.7E | 30    | 30   | 119   | 157   | 193 | 242 | 326 |     |     | 0  | -<br>10 | -<br>20 | -<br>20 | -<br>40 | -<br>15 |         |     |
| 03082006 | 17  | 19.5N | 132.1E | 35    | 29   | 68    | 72    | 126 | 142 | 202 | 252 | 342 | 0  | -5      | -<br>20 | -<br>25 | -<br>35 | -<br>10 | -<br>15 | -20 |
| 03082012 | 18  | 19.0N | 131.4E | 45    | 6    | 40    | 46    | 59  | 67  | 231 | 396 | 570 | -5 | -<br>15 | -<br>15 | -<br>35 | -<br>20 | -<br>15 | -<br>20 | -20 |
| 03082018 | 19  | 18.7N | 130.4E | 45    | 5    | 28    | 55    | 85  | 145 | 198 | 339 | 569 | 0  | -5      | -5      | -<br>15 | 10      | 10      | -<br>30 | -25 |
| 03082100 | 20  | 18.6N | 129.3E | 60    | 6    | 19    | 51    | 84  | 158 | 206 | 354 | 582 | 0  | 5       | -<br>10 | 5       | 10      | 5       | -<br>25 | -20 |

| 03082106 | 21 | 18.5N | 128.2E  | 65 | 8  | 49 | 72 | 142 | 173 | 209 | 358 |     | 0  | 0       | -5      | 10      | 10      | 0       | -<br>45 |    |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|----|
| 03082112 | 22 | 18.2N | 127.1E  | 65 | 0  | 38 | 59 | 105 | 118 | 157 | 260 |     | 0  | -<br>10 | 0       | 5       | 5       | -<br>10 | -<br>50 |    |
| 03082118 | 23 | 17.8N | 125.9E  | 75 | 8  | 18 | 72 | 77  | 85  | 170 | 396 |     | 0  | -5      | 5       | 5       | 10      | -<br>40 | -<br>45 |    |
| 03082200 | 24 | 17.7N | 124.5E  | 90 | 6  | 8  | 46 | 59  | 61  | 151 | 412 |     | 0  | 0       | 5       | 10      | 10      | -<br>35 | -<br>30 |    |
| 03082206 | 25 | 17.7N | 123.3E  | 90 | 22 | 42 | 42 | 42  | 61  | 185 |     |     | 0  | 5       | 10      | 15      | 5       | -<br>45 |         |    |
| 03082212 | 26 | 17.6N | 122.1E  | 80 | 0  | 60 | 62 | 46  | 62  | 152 |     |     | 0  | 10      | 15      | 10      | 0       | -<br>50 |         |    |
| 03082218 | 27 | 17.1N | 120.6E  | 70 | 12 | 17 | 13 | 18  | 34  | 96  |     |     | 0  | 10      | 15      | 10      | -<br>10 | -5      |         |    |
| 03082300 | 28 | 17.5N | 119.2E  | 70 | 13 | 26 | 24 | 49  | 56  | 148 |     |     | 0  | 10      | 10      | 5       | -5      | -<br>10 |         |    |
| 03082306 | 29 | 17.6N | 117.9E  | 70 | 0  | 0  | 6  | 25  | 54  |     |     |     | 0  | 10      | 10      | -<br>10 | -<br>40 |         |         |    |
| 03082312 | 30 | 17.9N | 116.8E  | 70 | 11 | 27 | 12 | 8   | 19  |     |     |     | 0  | 5       | 0       | -<br>20 | -<br>40 |         |         |    |
| 03082318 | 31 | 18.3N | 115.8E  | 70 | 13 | 29 | 26 | 39  | 58  |     |     |     | 0  | -5      | -<br>20 | -<br>35 | -<br>20 |         |         |    |
| 03082400 | 32 | 18.8N | 114.7E  | 75 | 12 | 34 | 41 | 59  | 96  |     |     |     | 0  | -5      | -<br>10 | -<br>30 | -<br>15 |         |         |    |
| 03082406 | 33 | 19.2N | 113.4E  | 80 | 0  | 12 | 31 | 62  |     |     |     |     | 0  | 0       | -<br>25 | -<br>35 |         |         |         |    |
| 03082412 | 34 | 19.6N | 112.2E  | 85 | 8  | 11 | 21 | 29  |     |     |     |     | 0  | -<br>15 | -<br>40 | -<br>25 |         |         |         |    |
| 03082418 | 35 | 20.0N | 111.1E  | 85 | 6  | 6  | 25 |     |     |     |     |     | 0  | -<br>20 | -<br>15 |         |         |         |         |    |
| 03082500 | 36 | 20.4N | 110.0E  | 80 | 12 | 38 | 84 |     |     |     |     |     | 0  | -<br>25 | -<br>10 |         |         |         |         |    |
| 03082506 | 37 | 20.8N | 108.9E  | 90 | 0  | 29 |    |     |     |     |     |     | 0  | -5      |         |         |         |         |         |    |
| 03082512 | 38 | 21.2N | 107.8E  | 90 | 5  | 13 |    |     |     |     |     |     | 0  | 0       |         |         |         |         |         |    |
| 03082518 | 39 | 21.5N | 106.7E  | 65 | 11 |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |    |
| 03082600 | 40 | 22.3N | 105.2E  | 50 | 16 |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |    |
|          |    |       | AVERAGE |    | 15 | 41 | 63 | 87  | 113 | 180 | 314 | 420 | 0  | 6       | 11      | 16      | 18      | 24      | 32      | 23 |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 0  | 0       | 0       | -1      | 0       | -1      | -<br>13 | -6 |
|          |    |       | # CASES |    | 40 | 38 | 36 | 33  | 31  | 27  | 12  | 8   | 40 | 38      | 36      | 33      | 31      | 27      | 12      | 8  |

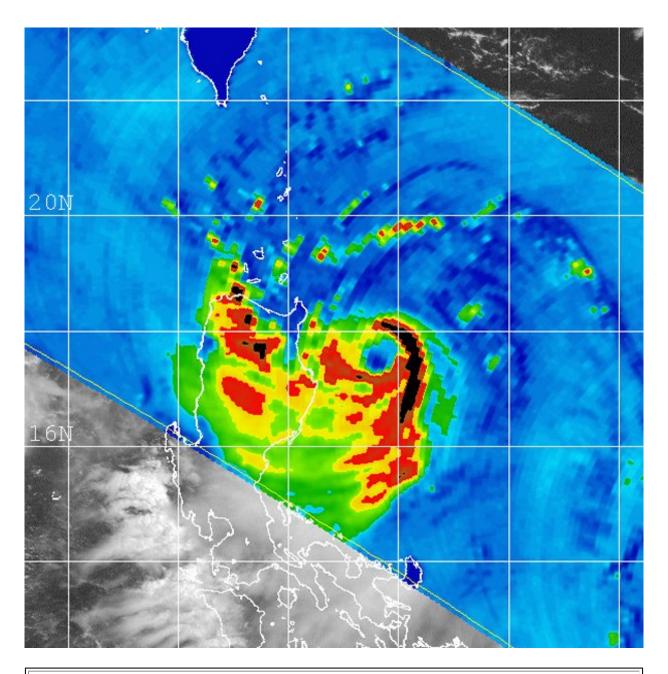


Figure 1-12W-1. 220353Z August 2003 SSMI/GOES-9 visible imagery of TY 12W (Krovanh), located 110 nm east of Luzon, Philippines prior to landfall at its peak intensity of 90 knots.

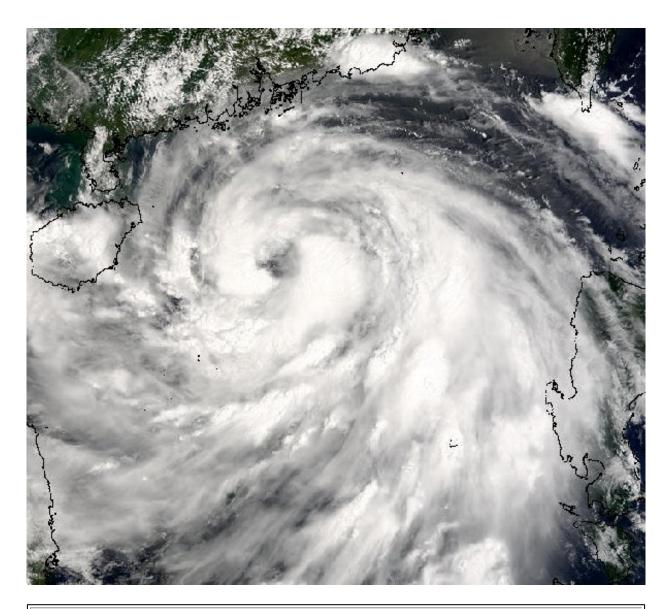
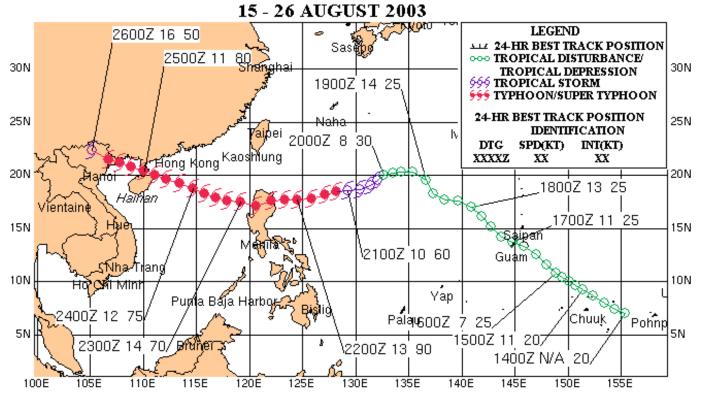
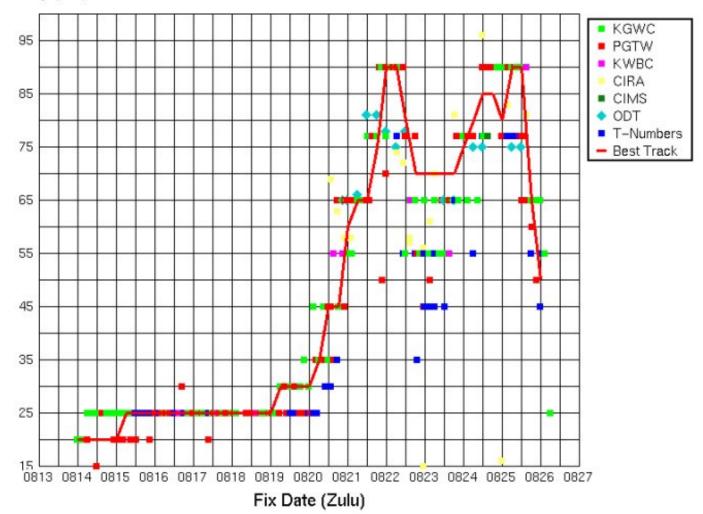


Figure 1-12W-2. 240300Z January 2003 MODIS true-color image of TY 12W (Krovanh), located in the South China Sea, with an intensity of 75 knots.

## TYPHOON 12W (KROVANH)



## Time Intensity for 12W



## Tropical Storm (TS) 13W (Vamco)\*



First Poor : 2130Z 17Aug 03

First Fair : 0600Z 18 Aug 03

First TCFA: 0000Z 19 Aug 03

First Warning: 0000Z 19 Aug 03

Last Warning: 1200Z 20 Aug 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Fanshan, China

Total Warnings: 07

Remarks:

- (1) The tropical disturbance that became the short-lived Tropical Storm (TS) 13W was first detected off the east coast of Luzon as a disturbance in the monsoon trough. This disturbance intensified, lifted northward out of the monsoon trough at 3 to 4 knots and consolidated into a depression, with the first warning being issued on 19 August at 0000Z. As the cyclone tracked northward and increased slowly in intensity, a low to mid level ridge to the northeast caused the cyclone to move more northwestward and accelerate towards mainland China. Continuous moderate vertical shear prevented the cyclone from intensifying into more than a weak tropical storm. The final warning for TS 13W was issued on 20 August at 1200Z, approximately 11 hours after landfall near Fanshan, China, where the cyclone rapidly dissipated over land.
- 2) No damage reports were received for this cyclone.
- \*Named by WMO Designated RSMC

|          |     |        | S         | tatist | ics f | or J | TWC  | on | TS | 313 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|--------|-----------|--------|-------|------|------|----|----|-----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     | ,      |           |        |       |      |      |    |    |     |    |     | ,   |    |     |     |    |    |    |     |
|          | WRN | BEST T | TRACK     |        | POS   | OITI | N ER | RO | RS |     |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG      | wind   | 00    | 12   | 24   | 36 | 48 | 72  | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03081818 |     | 18.8N  | 125.2E 20 |        |       |      |      |    |    |     |    |     |     |    |     |     |    |    |    |     |
| 03081900 | 1   | 20.8N  | 125.4E 25 | 50     | 171   | 272  | 360  |    |    |     |    | 0   | 0   | 0  | 20  |     |    |    |    |     |
| 03081906 | 2   | 22.8N  | 124.8E 30 | 0      | 62    | 126  | 211  |    |    |     |    | 0   | 0   | 20 | 15  |     |    |    |    |     |
| 03081912 | 3   | 24.3N  | 123.4E 30 | 6      | 36    | 146  |      |    |    |     |    | 0   | 5   | 10 |     |     |    |    |    |     |
| 03081918 | 4   | 25.8N  | 122.2E 35 | 17     | 69    | 104  |      |    |    |     |    | 0   | 15  | 10 |     |     |    |    |    |     |
| 03082000 | 5   | 27.2N  | 120.9E 35 | 16     | 34    |      |      |    |    |     |    | 0   | 5   |    |     |     |    |    |    |     |
| 03082006 | 6   | 28.3N  | 119.5E 25 | 0      | 19    |      |      |    |    |     |    | 0   | 0   |    |     |     |    |    |    |     |
| 03082012 | 7   | 29.8N  | 118.3E 20 | 0      |       |      |      |    |    |     |    | 0   |     |    |     |     |    |    |    |     |
| 03082018 |     | 30.5N  | 117.5E 20 |        |       |      |      |    |    |     |    |     |     |    |     |     |    |    |    |     |
|          |     |        | AVERAGE   | 13     | 65    | 162  | 285  |    |    |     |    | 0   | 4   | 10 | 18  |     |    |    |    |     |
|          |     |        | BIAS      |        |       |      |      |    |    |     |    | 0   | 4   | 10 | 18  |     |    |    |    |     |
|          |     |        | # CASES   | 7      | 6     | 4    | 2    |    |    |     |    | 7   | 6   | 4  | 2   |     |    |    |    |     |

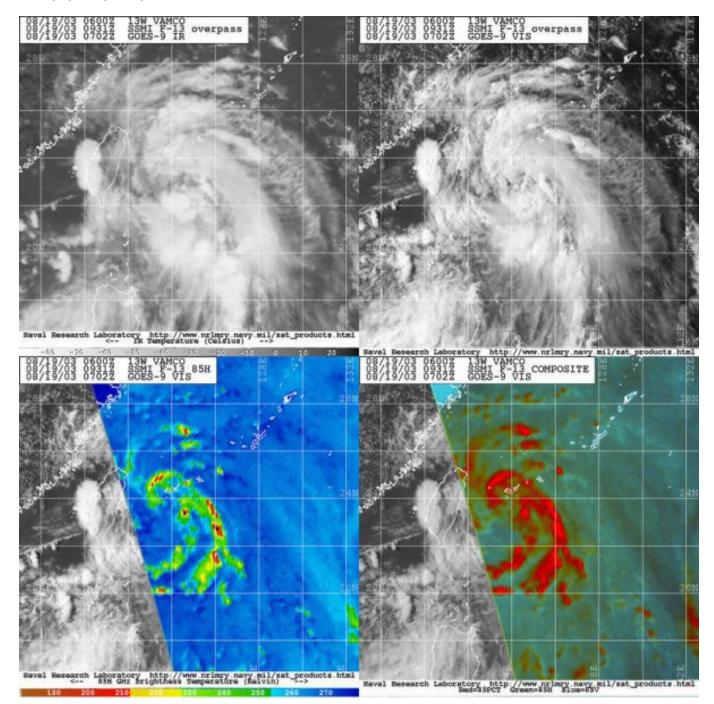
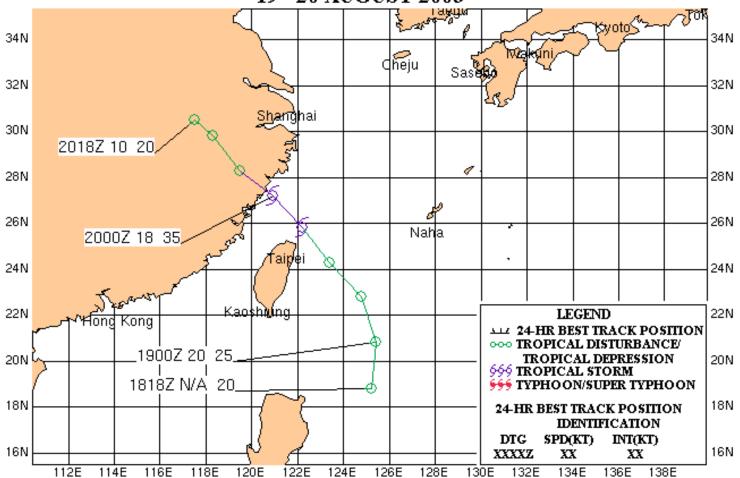


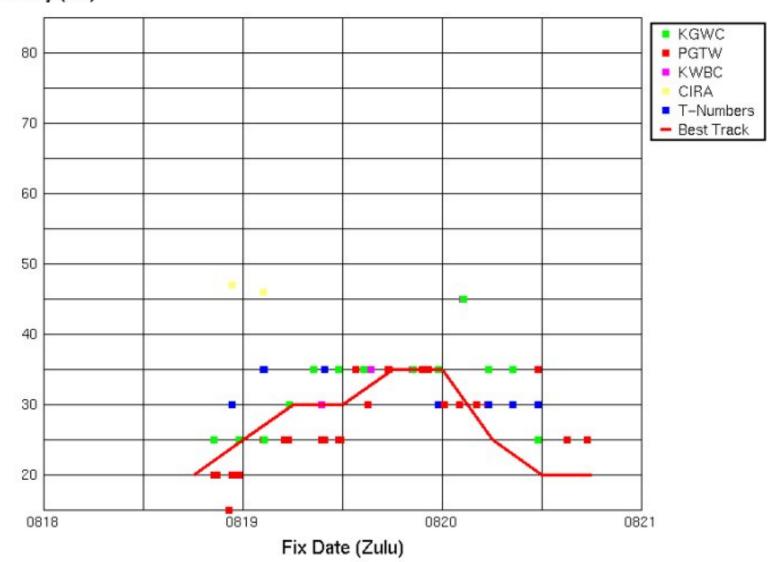
Figure 1-13W-1. 190931Z August 2003 GOES-9 multi-sensor satellite imagery of TY 13W (Vamco), located 180 nm east of Taiwan at its peak intensity of 35 knots.

#### TROPICAL STORM 13W (VAMCO)





# Time Intensity for 13W



### Tropical Storm (TS) 13W (Vamco)\*



First Poor : 2130Z 17Aug 03

First Fair : 0600Z 18 Aug 03

First TCFA: 0000Z 19 Aug 03

First Warning: 0000Z 19 Aug 03

Last Warning: 1200Z 20 Aug 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Fanshan, China

Total Warnings: 07

Remarks:

- (1) The tropical disturbance that became the short-lived Tropical Storm (TS) 13W was first detected off the east coast of Luzon as a disturbance in the monsoon trough. This disturbance intensified, lifted northward out of the monsoon trough at 3 to 4 knots and consolidated into a depression, with the first warning being issued on 19 August at 0000Z. As the cyclone tracked northward and increased slowly in intensity, a low to mid level ridge to the northeast caused the cyclone to move more northwestward and accelerate towards mainland China. Continuous moderate vertical shear prevented the cyclone from intensifying into more than a weak tropical storm. The final warning for TS 13W was issued on 20 August at 1200Z, approximately 11 hours after landfall near Fanshan, China, where the cyclone rapidly dissipated over land.
- 2) No damage reports were received for this cyclone.

\*Named by WMO Designated RSMC

|          |     |        | S         | tatist | ics f | or J | TWC  | on | TS | 13 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|--------|-----------|--------|-------|------|------|----|----|----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     |        |           |        |       |      |      |    |    |    |    |     |     |    |     |     |    |    |    |     |
|          | WRN | BEST 1 | TRACK     |        | POS   | OITI | N ER | RO | RS |    |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG      | wind   | 00    | 12   | 24   | 36 | 48 | 72 | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03081818 |     | 18.8N  | 125.2E 20 |        |       |      |      |    |    |    |    |     |     |    |     |     |    |    |    |     |
| 03081900 | 1   | 20.8N  | 125.4E 25 | 50     | 171   | 272  | 360  |    |    |    |    | 0   | 0   | 0  | 20  |     |    |    |    |     |
| 03081906 | 2   | 22.8N  | 124.8E 30 | 0      | 62    | 126  | 211  |    |    |    |    | 0   | 0   | 20 | 15  |     |    |    |    |     |
| 03081912 | 3   | 24.3N  | 123.4E 30 | 6      | 36    | 146  |      |    |    |    |    | 0   | 5   | 10 |     |     |    |    |    |     |
| 03081918 | 4   | 25.8N  | 122.2E 35 | 17     | 69    | 104  |      |    |    |    |    | 0   | 15  | 10 |     |     |    |    |    |     |
| 03082000 | 5   | 27.2N  | 120.9E 35 | 16     | 34    |      |      |    |    |    |    | 0   | 5   |    |     |     |    |    |    |     |
| 03082006 | 6   | 28.3N  | 119.5E 25 | 0      | 19    |      |      |    |    |    |    | 0   | 0   |    |     |     |    |    |    |     |
| 03082012 | 7   | 29.8N  | 118.3E 20 | 0      |       |      |      |    |    |    |    | 0   |     |    |     |     |    |    |    |     |
| 03082018 |     | 30.5N  | 117.5E 20 |        |       |      |      |    |    |    |    |     |     |    |     |     |    |    |    |     |
|          |     |        | AVERAGE   | 13     | 65    | 162  | 285  |    |    |    |    | 0   | 4   | 10 | 18  |     |    |    |    |     |
|          |     |        | BIAS      |        |       |      |      |    |    |    |    | 0   | 4   | 10 | 18  |     |    |    |    |     |
|          |     |        | # CASES   | 7      | 6     | 4    | 2    |    |    |    |    | 7   | 6   | 4  | 2   |     |    |    |    |     |

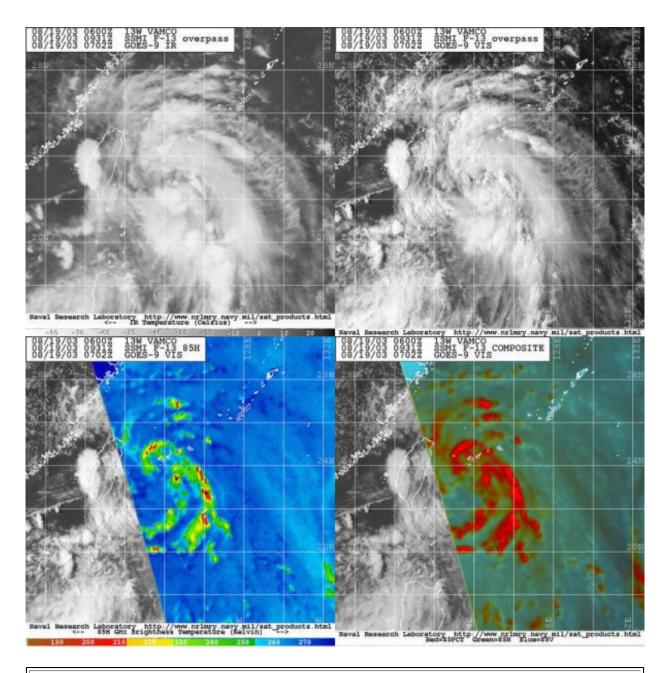
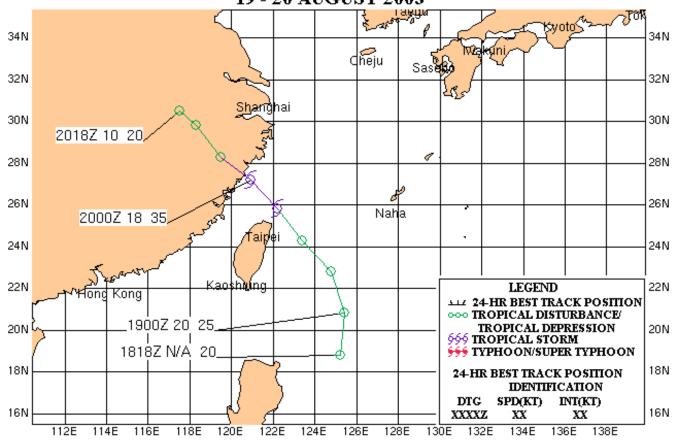
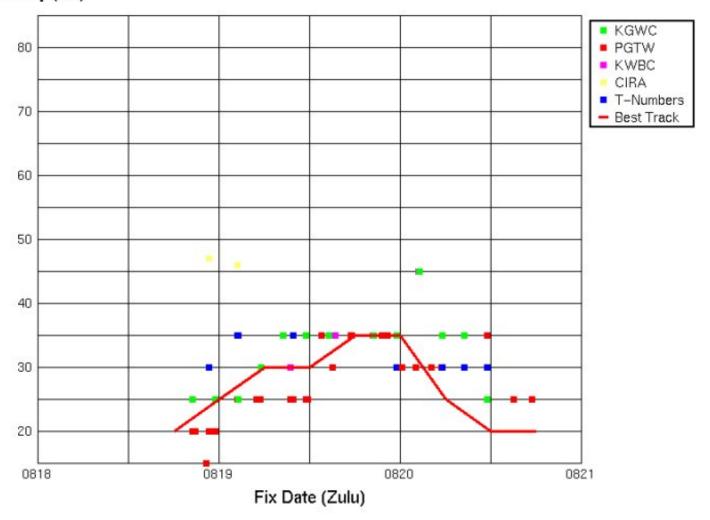


Figure 1-13W-1. 190931Z August 2003 GOES-9 multi-sensor satellite imagery of TY 13W (Vamco), located 180 nm east of Taiwan at its peak intensity of 35 knots.

#### TROPICAL STORM 13W (VAMCO) 19 - 20 AUGUST 2003



# Time Intensity for 13W



## Typhoon (TY) 14W (Dujuan)\*



First Poor: 0600Z 27 Aug 03

First Fair: 2300Z 27 Aug 03

First TCFA: 0000Z 28 Aug 03

First Warning: 0600Z 28 Aug 03

Last Warning: 0000Z 03 Sep 03, Dissipated

Max Intensity: 125 kts, gusts to 145 kts

Landfall: China, East of Hong Kong

Total Warnings: 24

Remarks:

(1) Typhoon (TY) 14W developed in the Philippine Sea, approximately 280 nm northwest of Guam, on 27 August 2003. TY 14W tracked southwestward for about 30 hours, under the influence of low to mid-level steering flow associated with a ridge to the north. From 0600Z on 29 August to 0600Z on 30 August, TY 14W underwent rapid intensification (2 Dvorak T-numbers) due to an upper level low northwest of the system which enhanced poleward outflow.

After 0000Z on 30 August, a mid-level ridge building eastward from Asian produced a northwestward track change, followed by a westward track change toward Hong Kong. Track speed also increased to 12 to 15 knots and intensification during this period was near the climatological mean of 1 Dvorak T-number/day.

By 2200Z on 31 August, microwave imagery indicated the presence of a concentric eyewalls and the cyclone attained maximum intensity of 125 knots shortly thereafter. TY 14W then slowly weakened as it tracked toward China and made landfall at typhoon strength around 1500Z on 02 September, just east of Hong Kong. The cyclone then rapidly decreased in intensity over China and the final warning was issued at 0000Z on 03 September.

(2) TY 14W passed 25 nm south of Taiwan, with an intensity of 120 knots on 01 September. Reports from Taiwan indicated rain and wind damage, flooding, and one missing person. Hong Kong shut the airport down during storm passage. Subsequent reports indicate 36 fatalities and 10 missing from areas near Hong Kong.

|          | WRN | BEST  | ΓRACK  |      | PC | SIT | ION | ERR | ORS |     |     |     | WI | ND      | ERF     | ROR     | S       |         |         |     |
|----------|-----|-------|--------|------|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT   | LONG   | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03082712 |     | 19.6N | 139.0E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082718 |     | 19.0N | 138.4E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082800 |     | 18.4N | 138.1E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082806 | 1   | 17.6N | 137.5E | 30   | 0  | 32  | 42  | 69  | 110 | 135 |     |     | 0  | 5       | 15      | 0       | 10      | -<br>20 |         |     |
| 03082812 | 2   | 16.8N | 136.7E | 35   | 5  | 19  | 50  | 79  | 146 | 181 | 156 | 347 | 0  | 10      | 10      | -5      | 0       | -<br>15 | -<br>40 | -10 |
| 03082818 | 3   | 16.5N | 136.0E | 35   | 12 | 30  | 71  | 108 | 160 | 144 | 197 | 408 | 0  | 10      | -5      | -<br>10 | -<br>10 | -<br>25 | -<br>40 | 20  |
| 03082900 | 4   | 16.3N | 135.5E | 35   | 16 | 37  | 82  | 104 | 127 | 134 | 254 | 462 | 0  | 0       | -<br>15 | -<br>15 | -<br>15 | -<br>50 | -<br>45 | 40  |
| 03082906 | 5   | 16.1N | 135.1E | 35   | 13 | 47  | 52  | 62  | 54  | 102 | 206 | 318 | 0  | -<br>15 | -<br>25 | -<br>20 | -<br>25 | -<br>45 | -<br>25 | 55  |
| 03082912 | 6   | 16.0N | 134.8E | 45   | 42 | 94  | 126 | 125 | 103 | 140 | 254 |     | 0  | -5      | 0       | 10      | 0       | -<br>20 | 5       |     |
| 03082918 | 7   | 16.0N | 134.6E | 60   | 46 | 64  | 83  | 97  | 93  | 173 | 289 |     | 0  | 10      | 20      | 15      | 10      | -5      | 45      |     |
| 03083000 | 8   | 16.1N | 134.3E | 70   | 0  | 48  | 91  | 140 | 148 | 272 | 385 |     | 0  | 20      | 25      | 15      | -<br>10 | -5      | 70      |     |
| 03083006 | 9   | 16.7N | 133.7E | 75   | 5  | 32  | 62  | 92  | 135 | 245 | 329 |     | 0  | 10      | 25      | 10      | -<br>10 | -<br>10 | 60      |     |
| 03083012 | 10  | 17.6N | 133.1E | 75   | 8  | 34  | 80  | 93  | 160 | 226 |     |     | 0  | 10      | 5       | -<br>15 | -<br>20 | -<br>15 |         |     |
| 03083018 | 11  | 18.4N | 132.2E | 80   | 0  | 23  | 46  | 67  | 86  | 156 |     |     | 0  | -5      | -5      | -<br>20 | -<br>20 | 5       |         |     |
| 03083100 | 12  | 19.2N | 131.1E | 80   | 0  | 33  | 51  | 74  | 90  | 208 |     |     | 0  | -<br>10 | -<br>25 | -<br>25 | -<br>30 | 25      |         |     |
| 03083106 | 13  | 19.8N | 129.6E | 90   | 0  | 30  | 45  | 73  | 88  | 188 |     |     | 0  | -5      | -<br>15 | -<br>20 | -<br>35 | 25      |         |     |
| 03083112 | 14  | 20.2N | 128.1E | 95   | 0  | 33  | 30  | 33  | 50  |     |     |     | -5 | -<br>20 | -<br>20 | -<br>35 | -<br>25 |         |         |     |

| 03083118 | 15 | 20.4N | 126.7E  | 100 | 0  | 6  | 29 | 39 | 94  |     |     |     | 0  | -<br>15 | -<br>15 | -<br>20 | 10 |         |    |    |
|----------|----|-------|---------|-----|----|----|----|----|-----|-----|-----|-----|----|---------|---------|---------|----|---------|----|----|
| 03090100 | 16 | 20.6N | 125.4E  | 120 | 6  | 34 | 57 | 73 | 155 |     |     |     | 0  | -5      | -<br>10 | -5      | 35 |         |    |    |
| 03090106 | 17 | 20.9N | 123.6E  | 120 | 12 | 41 | 49 | 96 | 98  |     |     |     | 0  | 5       | 0       | 20      | 35 |         |    |    |
| 03090112 | 18 | 21.2N | 121.8E  | 125 | 0  | 21 | 29 | 78 |     |     |     |     | 0  | -<br>10 | -<br>10 | 25      |    |         |    |    |
| 03090118 | 19 | 21.6N | 120.0E  | 120 | 0  | 8  | 46 | 96 |     |     |     |     | 0  | 10      | 15      | 5       |    |         |    |    |
| 03090200 | 20 | 22.0N | 118.2E  | 120 | 0  | 17 | 89 |    |     |     |     |     | 0  | 5       | 5       |         |    |         |    |    |
| 03090206 | 21 | 22.2N | 116.6E  | 105 | 5  | 56 | 90 |    |     |     |     |     | 0  | 20      | 15      |         |    |         |    |    |
| 03090212 | 22 | 22.5N | 114.7E  | 100 | 6  | 65 |    |    |     |     |     |     | 0  | 25      |         |         |    |         |    |    |
| 03090218 | 23 | 22.6N | 112.6E  | 65  | 0  | 16 |    |    |     |     |     |     | 0  | 5       |         |         |    |         |    |    |
| 03090300 | 24 | 22.6N | 110.5E  | 40  | 0  |    |    |    |     |     |     |     | 0  |         |         |         |    |         |    |    |
| 03090306 |    | 23.0N | 109.2E  | 30  |    |    |    |    |     |     |     |     |    |         |         |         |    |         |    |    |
|          |    |       | AVERAGE |     | 8  | 36 | 62 | 84 | 112 | 177 | 259 | 384 | 0  | 10      | 13      | 15      | 18 | 20      | 41 | 31 |
|          |    |       | BIAS    |     |    |    |    |    |     |     |     |     | 0  | 2       | 0       | -5      | -7 | -<br>12 | 4  | 26 |
|          |    |       | # CASES |     | 24 | 23 | 21 | 19 | 17  | 13  | 8   | 4   | 24 | 23      | 21      | 19      | 17 | 13      | 8  | 4  |

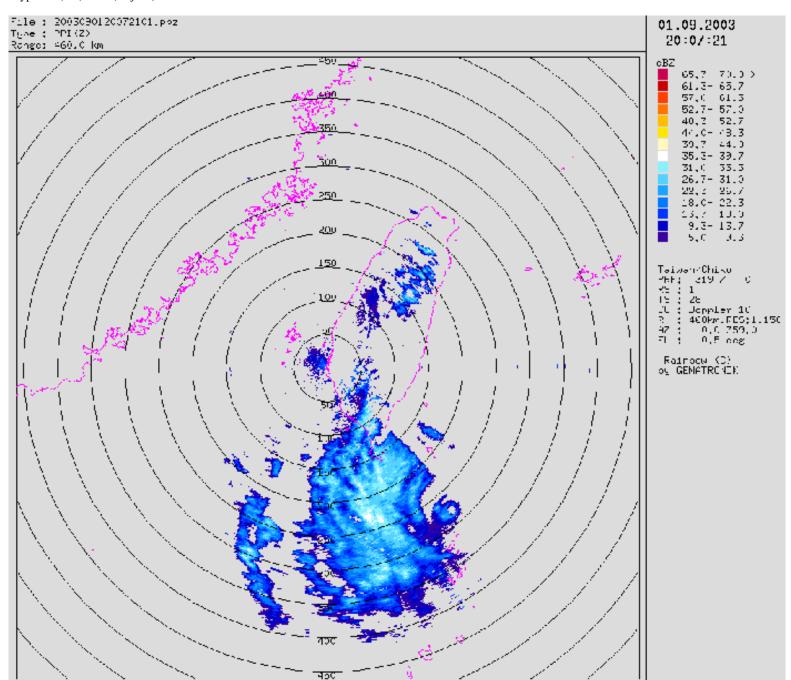


Figure 1-14W-1. 0122007Z September 2003 Taiwan Radar image showing the eye feature as the system passed south of Taiwan with an intensity of 120 knots.

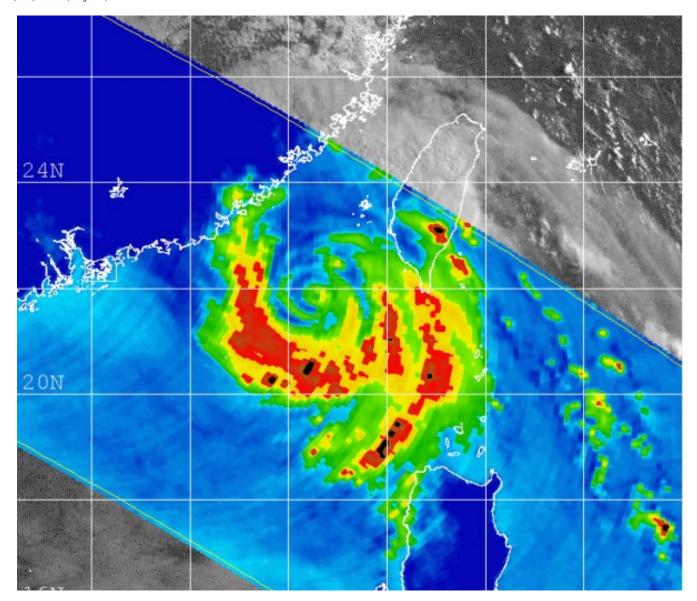


Figure 1-14W-2. 012232Z September 2003 GOES-9 85 GHz TRMM satellite imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.

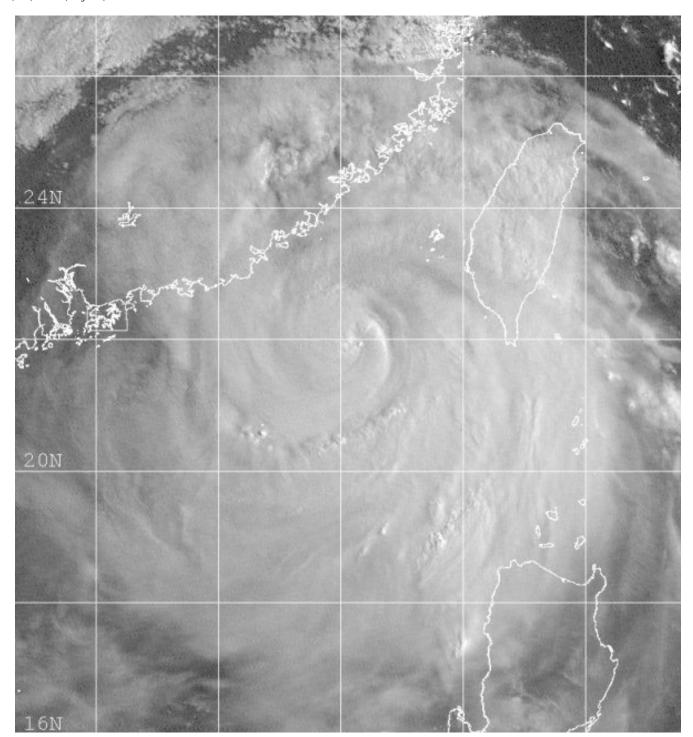


Figure 1-14W-3. 012325Z September 2003 GOES-9 visible imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.

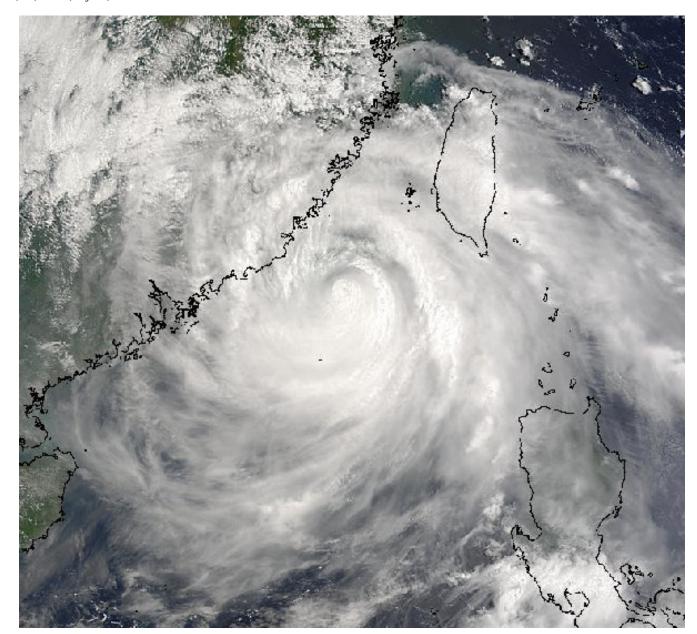
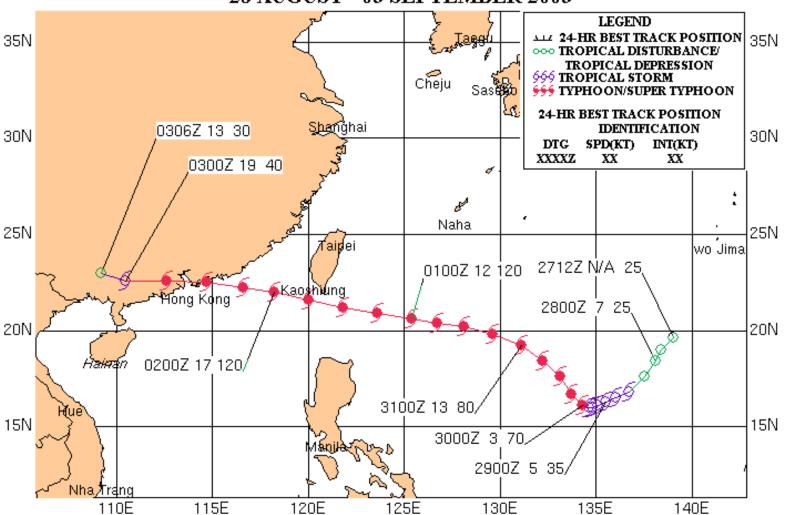
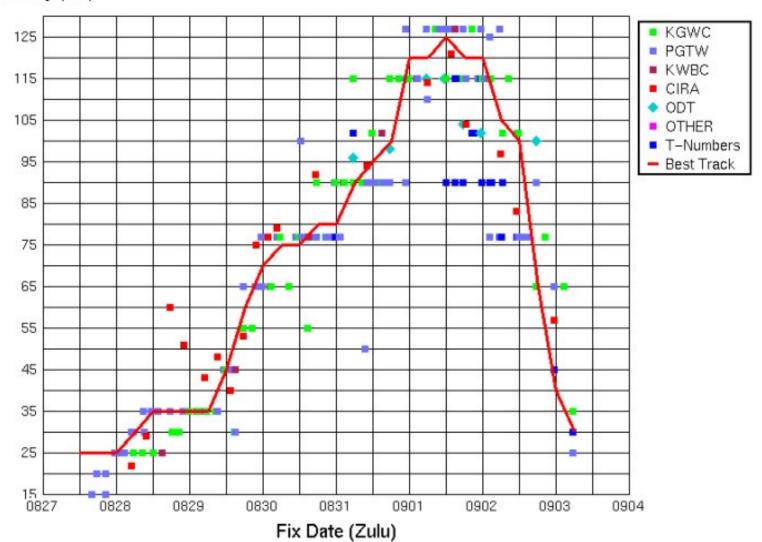


Figure 1-14W-4. 020250Z September 2003 MODIS true-color image of TY 14W (Dujuan), located in the South China Sea, with an intensity of 120 knots.

#### TYPHOON 14W (DUJUAN) 28 AUGUST - 03 SEPTEMBER 2003



## Time Intensity for 14W



### Typhoon (TY) 14W (Dujuan)\*



First Poor : 0600Z 27 Aug 03

First Fair : 2300Z 27 Aug 03

First TCFA: 0000Z 28 Aug 03

First Warning: 0600Z 28 Aug 03

Last Warning: 0000Z 03 Sep 03, Dissipated

Max Intensity: 125 kts, gusts to 145 kts

Landfall: China, East of Hong Kong

Total Warnings: 24

Remarks:

(1) Typhoon (TY) 14W developed in the Philippine Sea, approximately 280 nm northwest of Guam, on 27 August 2003. TY 14W tracked southwestward for about 30 hours, under the influence of low to mid-level steering flow associated with a ridge to the north. From 0600Z on 29 August to 0600Z on 30 August, TY 14W underwent rapid intensification (2 Dvorak T-numbers) due to an upper level low northwest of the system which enhanced poleward outflow.

After 0000Z on 30 August, a mid-level ridge building eastward from Asian produced a northwestward track change, followed by a westward track change toward Hong Kong. Track speed also increased to 12 to 15 knots and intensification during this period was near the climatological mean of 1 Dvorak T-number/day.

By 2200Z on 31 August, microwave imagery indicated the presence of a concentric eyewalls and the cyclone attained maximum intensity of 125 knots shortly thereafter. TY 14W then slowly weakened as it tracked toward China and made landfall at typhoon strength around 1500Z on 02 September, just east of Hong Kong. The cyclone then rapidly decreased in intensity over China and the final warning was issued at 0000Z on 03 September.

(2) TY 14W passed 25 nm south of Taiwan, with an intensity of 120 knots on 01 September. Reports from Taiwan indicated rain and wind damage, flooding, and one missing person. Hong Kong shut the airport down during storm passage. Subsequent reports indicate 36 fatalities and 10 missing from areas near Hong Kong.

\*Named by WMO designated RSMC

#### Statistics for JTWC on TY 14W

|          | WRN | BEST 7 | ΓRACK  |      | PC | SIT | ION | ERR | ORS | 3   |     |     | WI | ND      | ERF     | ROR     | S       |         |         |     |
|----------|-----|--------|--------|------|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT    | LONG   | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03082712 |     | 19.6N  | 139.0E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082718 |     | 19.0N  | 138.4E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082800 |     | 18.4N  | 138.1E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03082806 | 1   | 17.6N  | 137.5E | 30   | 0  | 32  | 42  | 69  | 110 | 135 |     |     | 0  | 5       | 15      | 0       | -<br>10 | -<br>20 |         |     |
| 03082812 | 2   | 16.8N  | 136.7E | 35   | 5  | 19  | 50  | 79  | 146 | 181 | 156 | 347 | 0  | 10      | 10      | -5      | 0       | -<br>15 | -<br>40 | -10 |
| 03082818 | 3   | 16.5N  | 136.0E | 35   | 12 | 30  | 71  | 108 | 160 | 144 | 197 | 408 | 0  | 10      | -5      | -<br>10 | -<br>10 | -<br>25 | -<br>40 | 20  |
| 03082900 | 4   | 16.3N  | 135.5E | 35   | 16 | 37  | 82  | 104 | 127 | 134 | 254 | 462 | 0  | 0       | -<br>15 | -<br>15 | -<br>15 | -<br>50 | -<br>45 | 40  |
| 03082906 | 5   | 16.1N  | 135.1E | 35   | 13 | 47  | 52  | 62  | 54  | 102 | 206 | 318 | 0  | -<br>15 | -<br>25 | -<br>20 | -<br>25 | -<br>45 | -<br>25 | 55  |
| 03082912 | 6   | 16.0N  | 134.8E | 45   | 42 | 94  | 126 | 125 | 103 | 140 | 254 |     | 0  | -5      | 0       | 10      | 0       | -<br>20 | 5       |     |
| 03082918 | 7   | 16.0N  | 134.6E | 60   | 46 | 64  | 83  | 97  | 93  | 173 | 289 |     | 0  | 10      | 20      | 15      | 10      | -5      | 45      |     |
| 03083000 | 8   | 16.1N  | 134.3E | 70   | 0  | 48  | 91  | 140 | 148 | 272 | 385 |     | 0  | 20      | 25      | 15      | -<br>10 | -5      | 70      |     |
| 03083006 | 9   | 16.7N  | 133.7E | 75   | 5  | 32  | 62  | 92  | 135 | 245 | 329 |     | 0  | 10      | 25      | 10      | -<br>10 | -<br>10 | 60      |     |
| 03083012 | 10  | 17.6N  | 133.1E | 75   | 8  | 34  | 80  | 93  | 160 | 226 |     |     | 0  | 10      | 5       | -<br>15 | -<br>20 | -<br>15 |         |     |
| 03083018 | 11  | 18.4N  | 132.2E | 80   | 0  | 23  | 46  | 67  | 86  | 156 |     |     | 0  | -5      | -5      | -<br>20 | -<br>20 | 5       |         |     |
| 03083100 | 12  | 19.2N  | 131.1E | 80   | 0  | 33  | 51  | 74  | 90  | 208 |     |     | 0  | -<br>10 | -<br>25 | -<br>25 | -<br>30 | 25      |         |     |
| 03083106 | 13  | 19.8N  | 129.6E | 90   | 0  | 30  | 45  | 73  | 88  | 188 |     |     | 0  | -5      | -<br>15 | -<br>20 | -<br>35 | 25      |         |     |
| 03083112 | 14  | 20.2N  | 128.1E | 95   | 0  | 33  | 30  | 33  | 50  |     |     |     | -5 | -<br>20 | -<br>20 | -<br>35 | -<br>25 |         |         |     |
| 03083118 | 15  | 20.4N  | 126.7E | 100  | 0  | 6   | 29  | 39  | 94  |     |     |     | 0  | -<br>15 | -<br>15 | -<br>20 | 10      |         |         |     |
| 03090100 | 16  | 20.6N  | 125.4E | 120  | 6  | 34  | 57  | 73  | 155 |     |     |     | 0  | -5      | -<br>10 | -5      | 35      |         |         |     |
| 03090106 | 17  | 20.9N  | 123.6E | 120  | 12 | 41  | 49  | 96  | 98  |     |     |     | 0  | 5       | 0       | 20      | 35      |         |         |     |
| 03090112 | 18  | 21.2N  | 121.8E | 125  | 0  | 21  | 29  | 78  |     |     |     |     | 0  | -<br>10 | -<br>10 | 25      |         |         |         |     |
| 03090118 | 19  | 21.6N  | 120.0E | 120  | 0  | 8   | 46  | 96  |     |     |     |     | 0  | 10      | 15      | 5       |         |         |         |     |
| 03090200 | 20  | 22.0N  | 118.2E | 120  | 0  | 17  | 89  |     |     |     |     |     | 0  | 5       | 5       |         |         |         |         |     |
| 03090206 | 21  | 22.2N  | 116.6E | 105  | 5  | 56  | 90  |     |     |     |     |     | 0  | 20      | 15      |         |         |         |         |     |
| 03090212 | 22  | 22.5N  | 114.7E | 100  | 6  | 65  |     |     |     |     |     |     | 0  | 25      |         |         |         |         |         |     |

| 03090218 | 23 | 22.6N | 112.6E  | 65 | 0  | 16 |    |    |     |     |     |     | 0  | 5  |    |    |    |         |    |    |
|----------|----|-------|---------|----|----|----|----|----|-----|-----|-----|-----|----|----|----|----|----|---------|----|----|
| 03090300 | 24 | 22.6N | 110.5E  | 40 | 0  |    |    |    |     |     |     |     | 0  |    |    |    |    |         |    |    |
| 03090306 |    | 23.0N | 109.2E  | 30 |    |    |    |    |     |     |     |     |    |    |    |    |    |         |    |    |
|          |    |       | AVERAGE |    | 8  | 36 | 62 | 84 | 112 | 177 | 259 | 384 | 0  | 10 | 13 | 15 | 18 | 20      | 41 | 31 |
|          |    |       | BIAS    |    |    |    |    |    |     |     |     |     | 0  | 2  | 0  | -5 | -7 | -<br>12 | 4  | 26 |
|          |    |       | # CASES |    | 24 | 23 | 21 | 19 | 17  | 13  | 8   | 4   | 24 | 23 | 21 | 19 | 17 | 13      | 8  | 4  |

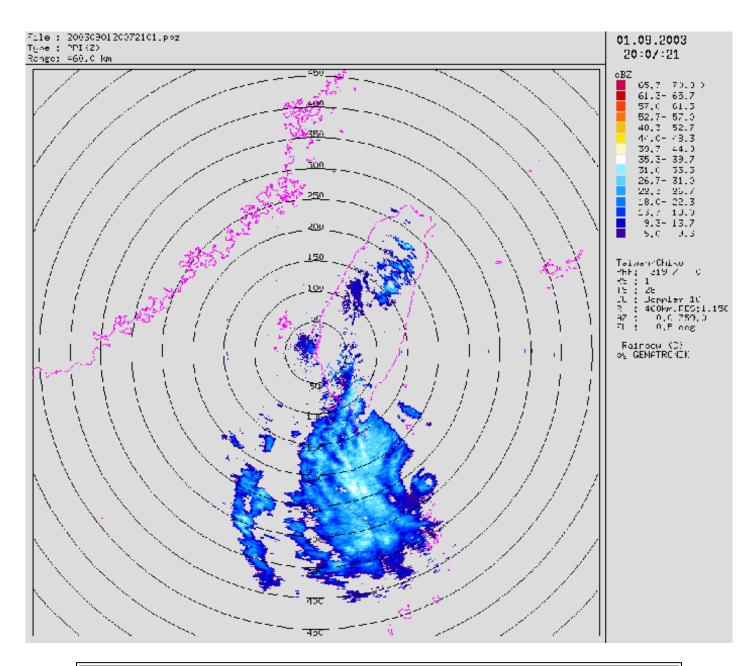


Figure 1-14W-1. 0122007Z September 2003 Taiwan Radar image showing the eye feature as the system passed south of Taiwan with an intensity of 120 knots.

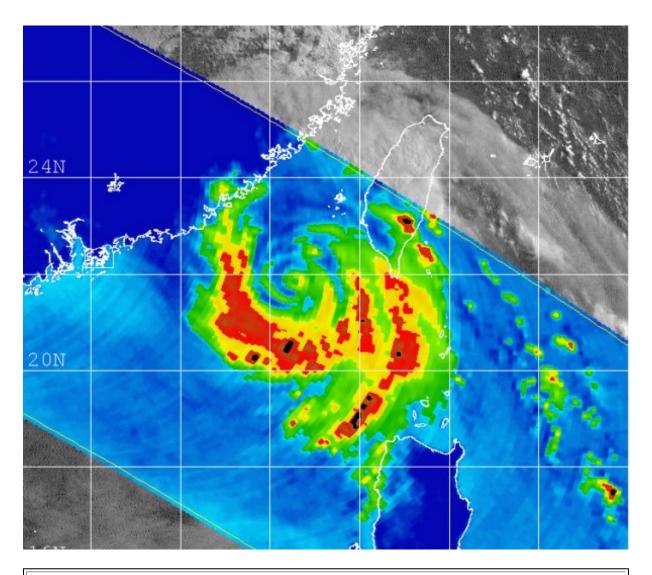


Figure 1-14W-2. 012232Z September 2003 GOES-9 85 GHz TRMM satellite imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.

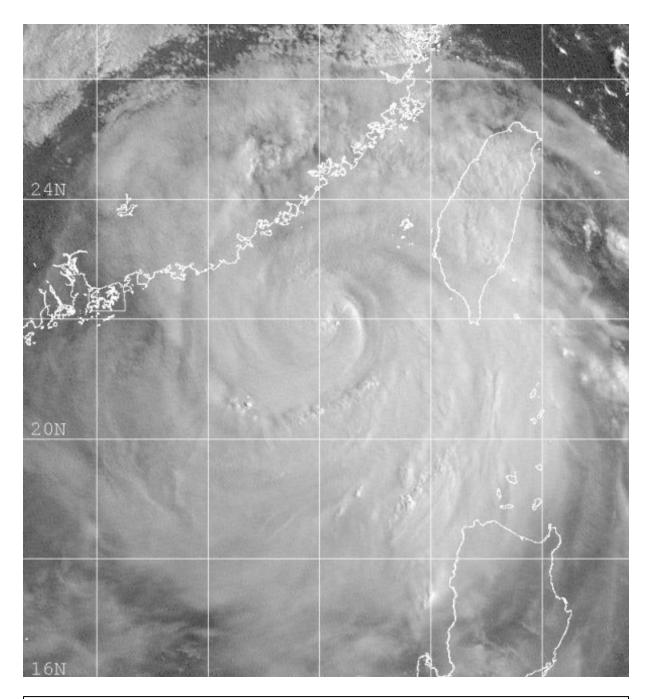


Figure 1-14W-3. 012325Z September 2003 GOES-9 visible imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.

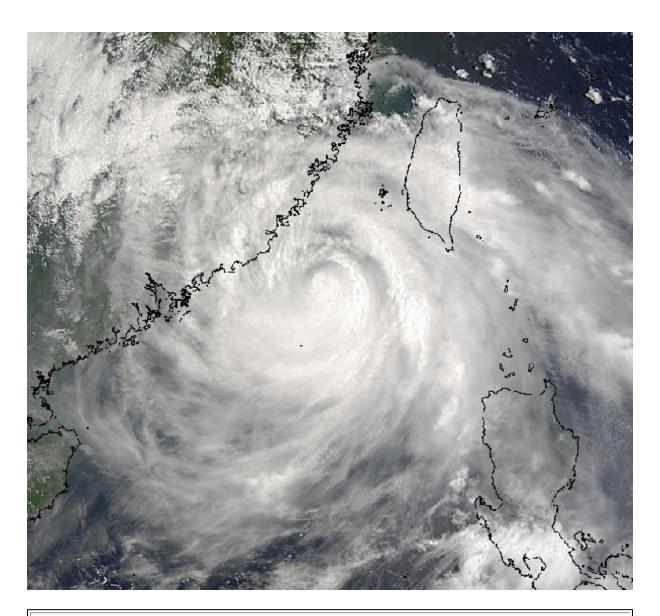
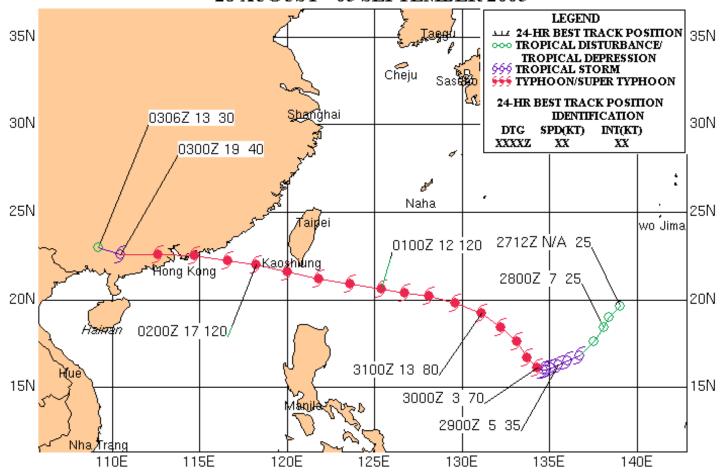
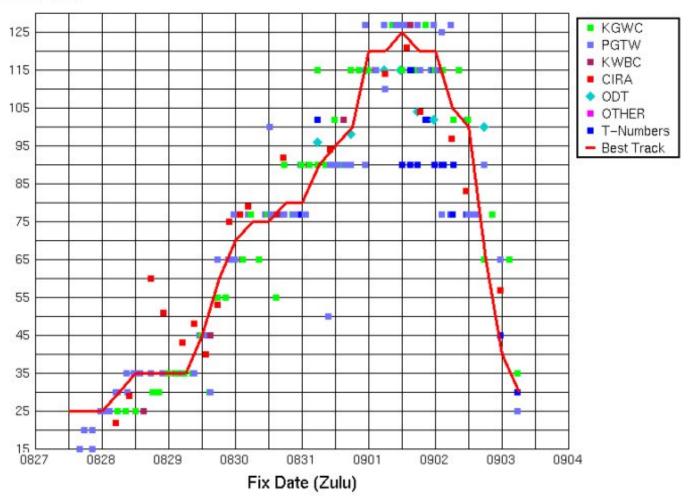


Figure 1-14W-4. 020250Z September 2003 MODIS true-color image of TY 14W (Dujuan), located in the South China Sea, with an intensity of 120 knots.

#### TYPHOON 14W (DUJUAN) 28 AUGUST - 03 SEPTEMBER 2003



## Time Intensity for 14W



## Super Typhoon (STY) 15W (Maemi)\*



First Poor : 0600Z 02 Sep 03

First Fair: 0600Z 03 Sep 03

First TCFA: 0200Z 05 Sep 03

First Warning: 1800Z 05 Sep 03

Last Warning: 0600Z 13 Sep 03

Max Intensity: 150 kts, gusts to 180 kts

Landfall: Kosong, South Korea

Total Warnings: 31

#### Remarks:

1) Super Typhoon (STY) 15W formed in the monsoon trough approximately sixty nautical miles east-southeast of Guam. This cyclone tracked northwestward over Guam as a suspect area before being warned on. The cyclone initially intensified at a less than climatological rate as it tracked in an environment of moderate upper level outflow and low to moderate vertical windshear and attained typhoon strength at 1200Z on September 7th.

As STY 15W moved northwestward 300 to 400 miles southeast of Okinawa, a mid-latitude trough tracking east off China weakened the mid-level subtropical ridge, which allowed the cyclone to move poleward after 1200Z on 10 September. STY 15W experienced rapid intensification (two T-numbers / 24 hours) beginning around 1800Z on 8 September due to enhanced upper level outflow. The rapid rate of intensification allowed the cyclone to reach super typhoon strength by 091200Z and attain maximum intensity of 150 knots 12 hours later.

STY 15W passed approximately 120NM west of Okinawa between 0600z and 1200Z on 11 September, then made landfall at Konsong, South Korea near 1300Z on 12 September and, subsequently, tracked along the southeastern coast of Korea. STY 15W then moved into the Sea of Japan and became an extratropical system at around 0600Z on 13 September.

2) One fatality was reported and a further 93 injuries as STY 15W tracked over the islands of Miyakojima and Kumejima in the Okinawa prefecture, approximately 200 nautical miles southwest of Naha, Okinawa. These islands sustained property damage, flight cancellations and extensive loss of

electricity. Peak sustained winds of 33 knots gusting to 47 knots were measured at Kadena Air Base. Southern Japan received significant precipitation and 48 people were evacuated from their homes in Nagasaki prefecture where landslides were reported. STY 15W was one of the most intense cyclones to strike Korea according to available records. STY 15W made landfall in Kosong, South Korea at an intensity of approximately 90 knots and caused over 120 fatalities, with thousands evacuated and approximately 1.2 billion dollars in damage reported.

\*Named by WMO Designated RSMC

|          |     |       |        | Statis | stic | s f | or J | TWC | on  | STY | ′15W | /   |    |    |     |         |         |         |         |     |
|----------|-----|-------|--------|--------|------|-----|------|-----|-----|-----|------|-----|----|----|-----|---------|---------|---------|---------|-----|
|          |     |       |        |        |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |        | PO   | SIT | ION  | ERR | ORS |     |      |     | WI | ND | ERR | ROR     | S       |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind   | 00   | 12  | 24   | 36  | 48  | 72  | 96   | 120 | 00 | 12 | 24  | 36      | 48      | 72      | 96      | 120 |
| 03090406 |     | 9.6N  | 150.9E | 20     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090412 |     | 10.3N | 149.5E | 25     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090418 |     | 11.3N | 148.4E | 25     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090500 |     | 12.6N | 147.6E | 25     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090506 |     | 13.0N | 146.1E | 25     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090512 |     | 13.5N | 144.6E | 30     |      |     |      |     |     |     |      |     |    |    |     |         |         |         |         |     |
| 03090518 | 1   | 14.1N | 143.3E | 35     | 26   | 85  | 125  | 171 | 167 | 132 |      |     | -5 | 0  | 0   | 0       | 0       | 0       |         |     |
| 03090600 | 2   | 14.6N | 142.1E | 40     | 13   | 13  | 66   | 115 | 98  | 127 | 204  | 244 | 0  | 5  | 5   | 10      | 10      | 0       | -<br>50 | -15 |
| 03090606 | 3   | 15.2N | 141.0E | 40     | 11   | 51  | 74   | 66  | 48  | 57  | 169  | 257 | 0  | 0  | 5   | 5       | 15      | -<br>20 | -<br>45 | -20 |
| 03090612 | 4   | 15.9N | 140.0E | 45     | 26   | 38  | 54   | 43  | 21  | 99  | 207  | 248 | 0  | -5 | 5   | 5       | 15      | -<br>30 | -<br>45 | -20 |
| 03090618 | 5   | 16.7N | 138.9E | 50     | 8    | 41  | 58   | 62  | 70  | 106 | 110  | 120 | 0  | 5  | 10  | 15      | 30      | -<br>15 | -<br>10 | 0   |
| 03090700 | 6   | 17.4N | 137.7E | 60     | 13   | 49  | 49   | 54  | 85  | 118 | 125  | 76  | 0  | 15 | 15  | 20      | 20      | -<br>30 | 0       | 0   |
| 03090706 | 7   | 18.3N | 136.7E | 60     | 8    | 21  | 12   | 13  | 30  | 20  | 103  | 112 | 0  | 5  | 15  | 20      | -5      | -<br>30 | -<br>10 | 15  |
| 03090712 | 8   | 19.0N | 135.8E | 60     | 26   | 25  | 13   | 31  | 48  | 16  | 8    | 271 | 5  | 5  | 15  | 10      | -<br>20 | -<br>30 | -<br>10 | 20  |
| 03090718 | 9   | 19.4N | 134.8E | 65     | 12   | 13  | 13   | 25  | 21  | 44  | 96   | 133 | 0  | 5  | 15  | -<br>15 | -<br>25 | -<br>20 | -<br>20 | 10  |

| 03090800 | 10 | 19.9N | 134.0E  | 70  | 8  | 18 | 16 | 33  | 38  | 73  | 62  | 207 | 0  | 5       | 0       | -<br>25 | -<br>40 | 10      | -<br>30 | 10 |
|----------|----|-------|---------|-----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|----|
| 03090806 | 11 | 20.2N | 133.0E  | 70  | 16 | 13 | 19 | 33  | 33  | 126 | 50  | 235 | 0  | 5       | -<br>25 | -<br>30 | -<br>40 | -<br>20 | -<br>10 | 25 |
| 03090812 | 12 | 20.6N | 132.0E  | 75  | 12 | 25 | 43 | 41  | 55  | 51  | 181 | 416 | 0  | -5      | -<br>35 | -<br>45 | -<br>40 | -<br>20 | 0       | 30 |
| 03090818 | 13 | 21.1N | 131.1E  | 75  | 12 | 25 | 18 | 25  | 56  | 60  | 333 |     | 0  | -<br>30 | -<br>35 | -<br>45 | -<br>20 | -5      | 15      |    |
| 03090900 | 14 | 21.8N | 130.3E  | 90  | 11 | 30 | 58 | 81  | 107 | 89  | 329 |     | 0  | -<br>25 | -<br>35 | 30      | 0       | 0       | 10      |    |
| 03090906 | 15 | 22.4N | 129.5E  | 115 | 5  | 25 | 62 | 110 | 128 | 74  | 239 |     | 0  | -5      | -<br>20 | -5      | 0       | 15      | 25      |    |
| 03090912 | 16 | 22.9N | 128.7E  | 130 | 5  | 42 | 65 | 96  | 104 | 91  | 214 |     | 0  | -<br>10 | -<br>10 | 0       | -<br>15 | 15      | 20      |    |
| 03090918 | 17 | 23.3N | 127.8E  | 130 | 6  | 30 | 60 | 82  | 47  | 135 |     |     | 0  | -<br>10 | 5       | -<br>10 | -5      | 20      |         |    |
| 03091000 | 18 | 23.6N | 127.2E  | 150 | 5  | 23 | 57 | 48  | 30  | 192 |     |     | 0  | 0       | 10      | -<br>10 | -<br>10 | 0       |         |    |
| 03091006 | 19 | 24.0N | 126.7E  | 150 | 8  | 25 | 24 | 16  | 49  | 98  |     |     | 0  | 5       | -5      | -5      | -5      | 5       |         |    |
| 03091012 | 20 | 24.3N | 126.1E  | 150 | 0  | 30 | 43 | 48  | 49  | 125 |     |     | 0  | 15      | -<br>10 | -<br>10 | 0       | 10      |         |    |
| 03091018 | 21 | 24.7N | 125.6E  | 135 | 8  | 25 | 22 | 70  | 118 |     |     |     | 0  | -<br>10 | 0       | -5      | -<br>10 |         |         |    |
| 03091100 | 22 | 25.2N | 125.3E  | 125 | 8  | 32 | 43 | 104 | 121 |     |     |     | 5  | -<br>15 | -<br>10 | -<br>10 | -<br>15 |         |         |    |
| 03091106 | 23 | 25.9N | 125.3E  | 135 | 13 | 36 | 83 | 125 | 187 |     |     |     | 0  | 5       | 0       | 5       | 0       |         |         |    |
| 03091112 | 24 | 27.0N | 125.5E  | 135 | 13 | 60 | 87 | 114 | 154 |     |     |     | 0  | 0       | 5       | 0       | 0       |         |         |    |
| 03091118 | 25 | 28.6N | 125.8E  | 120 | 12 | 52 | 74 | 103 |     |     |     |     | 0  | 5       | -5      | 0       |         |         |         |    |
| 03091200 | 26 | 30.6N | 126.5E  | 120 | 5  | 13 | 22 | 82  |     |     |     |     | 0  | 5       | 0       | 0       |         |         |         |    |
| 03091206 | 27 | 32.7N | 127.1E  | 105 | 5  | 19 | 58 |     |     |     |     |     | 0  | -<br>10 | 0       |         |         |         |         |    |
| 03091212 | 28 | 34.8N | 128.3E  | 95  | 0  | 15 | 75 |     |     |     |     |     | -5 | -<br>15 | -5      |         |         |         |         |    |
| 03091218 | 29 | 36.9N | 129.7E  | 80  | 0  | 29 |    |     |     |     |     |     | 0  | 0       |         |         |         |         |         |    |
| 03091300 | 30 | 38.9N | 131.5E  | 75  | 12 | 45 |    |     |     |     |     |     | 0  | 5       |         |         |         |         |         |    |
| 03091306 | 31 | 40.6N | 134.7E  | 60  | 7  |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |    |
| 03091312 |    | 42.2N | 137.9E  | 55  |    |    |    |     |     |     |     |     |    |         |         |         |         |         |         |    |
|          |    |       | AVERAGE |     | 10 | 32 | 50 | 69  | 78  | 92  | 162 | 211 | 1  | 8       | 11      | 13      | 14      | 15      | 20      | 15 |
|          |    |       | BIAS    |     |    |    |    |     |     |     |     |     | 0  | -2      | -3      | -6      | -7      | -8      | -<br>11 | 5  |
|          |    |       | # CASES |     | 31 | 30 | 28 | 26  | 24  | 20  | 15  | 11  | 31 | 30      | 28      | 26      | 24      | 20      | 15      | 11 |

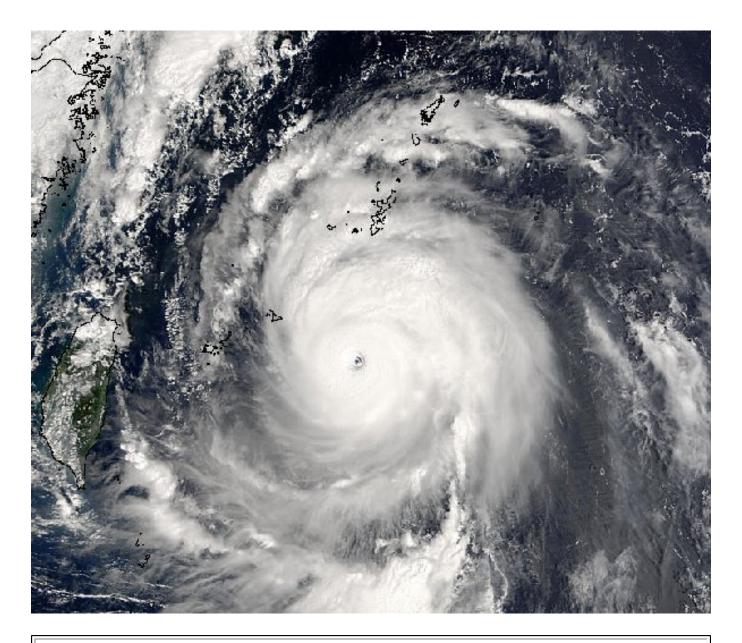


Figure 1-15W-1. 100200Z September 2003 MODIS true-color image of STY 15W (Maemi), located 330nm east of Taiwan, with a maximum intensity of 150 knots.

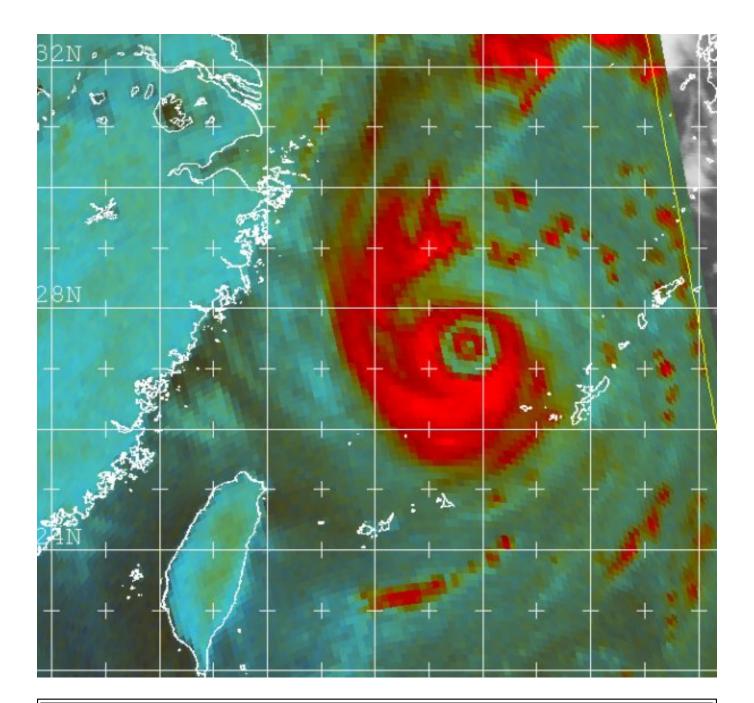


Figure 1-15W-2. 111251Z September 2003 color composite SSM/I imagery of STY 15W (Maemi), the system was undergoing a concentric eyewall cycle. located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

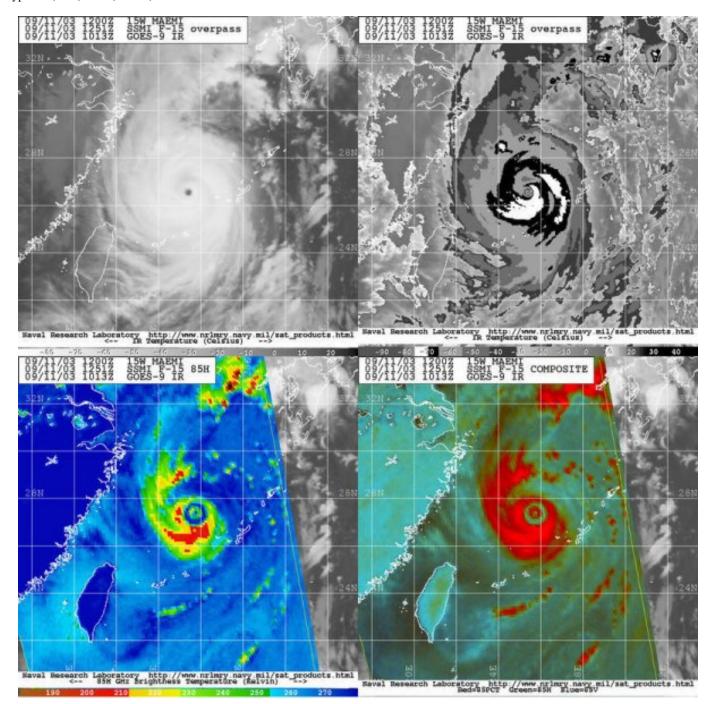
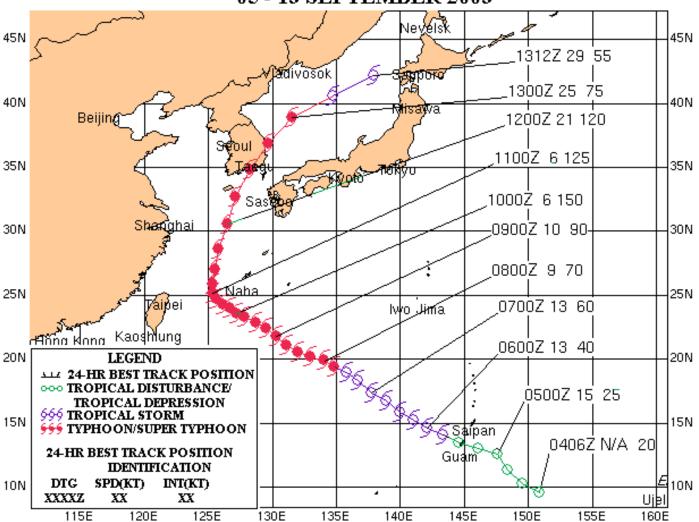
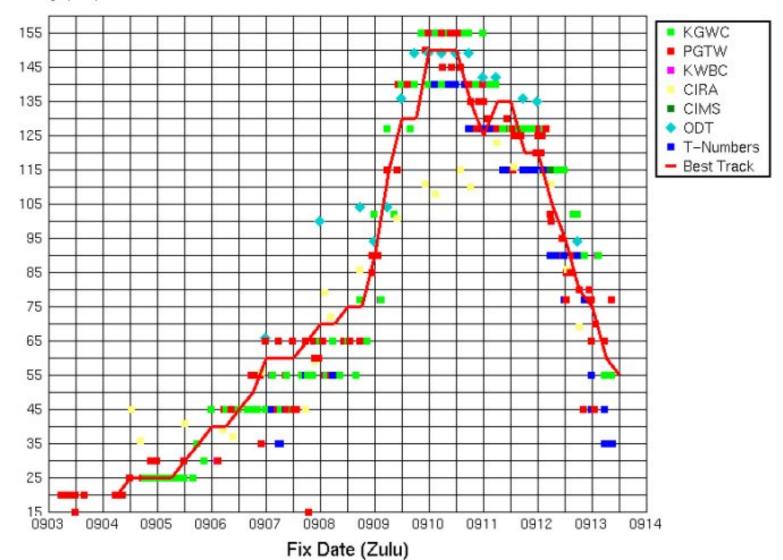


Figure 1-15W-3. 111251Z September 2003 85 GHz multi-sensor imagery of STY 15W (Maemi), located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

### SUPER TYPHOON 15W (MAEMI) 05 - 13 SEPTEMBER 2003



## Time Intensity for 15W



### Super Typhoon (STY) 15W (Maemi)\*



First Poor : 0600Z 02 Sep 03

First Fair : 0600Z 03 Sep 03

First TCFA: 0200Z 05 Sep 03

First Warning: 1800Z 05 Sep 03

Last Warning: 0600Z 13 Sep 03

Max Intensity: 150 kts, gusts to 180 kts

Landfall: Kosong, South Korea

Total Warnings: 31

#### Remarks:

1) Super Typhoon (STY) 15W formed in the monsoon trough approximately sixty nautical miles east-southeast of Guam. This cyclone tracked northwestward over Guam as a suspect area before being warned on. The cyclone initially intensified at a less than climatological rate as it tracked in an environment of moderate upper level outflow and low to moderate vertical windshear and attained typhoon strength at 1200Z on September 7th.

As STY 15W moved northwestward 300 to 400 miles southeast of Okinawa, a mid-latitude trough tracking east off China weakened the mid-level subtropical ridge, which allowed the cyclone to move poleward track after 1200Z on 10 September. STY 15W experienced rapid intensification (two T-numbers / 24 hours) beginning around 1800Z on 8 September due to enhanced upper level outflow. The rapid rate of intensification allowed the cyclone to reach super typhoon strength by 091200Z and attain maximum intensity of 150 knots 12 hours later.

STY 15W passed approximately 120NM west of Okinawa between 0600z and 1200Z on 11 September, then made landfall at Konsong, South Korea near 1300Z on 12 September and, subsequently, tracked along the southeastern coast of Korea. STY 15W then moved into the Sea of Japan and became an extratropical system at around 0600Z on 13 September.

2) One fatality was reported and a further 93 injuries as STY 15W tracked over the islands of Miyakojima and Kumejima in Okinawa prefecture, approximately 200 nautical miles southwest of Naha, Okinawa. These islands sustained property damage, flight cancellations and extensive loss of electricity. Peak sustained winds of 33 knots gusting to 47 knots were measured at Kadena Air Base. Southern Japan received significant precipitation and 48 people were evacuated from their homes in Nagasaki prefecture where landslides were reported. STY 15W was one of the most intense cyclones

to strike Korea according to available records. STY 15W made landfall in Kosong, South Korea at an intensity of approximately 90 knots and caused over 120 fatalities, with thousands evacuated and approximately 1.2 billion dollars in damage reported.

|          |        |       |        | Stati | stic | s f | or J | TWC | on  | STY | ′15W | /   |      |    |         |         |         |         |         |     |
|----------|--------|-------|--------|-------|------|-----|------|-----|-----|-----|------|-----|------|----|---------|---------|---------|---------|---------|-----|
|          | MACONI | DEGT  | TDAOK  |       | D0   | OIT | ION  |     | 000 |     |      |     | 14/1 | ND |         | 000     |         |         |         |     |
|          |        |       | TRACK  |       |      |     |      | ERR |     |     |      |     |      |    | ERR     |         |         |         |         |     |
| DTG      | NO.    | LAT   | LONG   | wind  | 00   | 12  | 24   | 36  | 48  | 72  | 96   | 120 | 00   | 12 | 24      | 36      | 48      | 72      | 96      | 120 |
| 03090406 |        | 9.6N  | 150.9E | 20    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090412 |        |       | 149.5E | 25    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090418 |        | 11.3N | 148.4E | 25    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090500 |        | 12.6N | 147.6E | 25    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090506 |        | 13.0N | 146.1E | 25    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090512 |        | 13.5N | 144.6E | 30    |      |     |      |     |     |     |      |     |      |    |         |         |         |         |         |     |
| 03090518 | 1      | 14.1N | 143.3E | 35    | 26   | 85  | 125  | 171 | 167 | 132 |      |     | -5   | 0  | 0       | 0       | 0       | 0       |         |     |
| 03090600 | 2      | 14.6N | 142.1E | 40    | 13   | 13  | 66   | 115 | 98  | 127 | 204  | 244 | 0    | 5  | 5       | 10      | 10      | 0       | -<br>50 | -15 |
| 03090606 | 3      | 15.2N | 141.0E | 40    | 11   | 51  | 74   | 66  | 48  | 57  | 169  | 257 | 0    | 0  | 5       | 5       | 15      | -<br>20 | -<br>45 | -20 |
| 03090612 | 4      | 15.9N | 140.0E | 45    | 26   | 38  | 54   | 43  | 21  | 99  | 207  | 248 | 0    | -5 | 5       | 5       | 15      | -<br>30 | -<br>45 | -20 |
| 03090618 | 5      | 16.7N | 138.9E | 50    | 8    | 41  | 58   | 62  | 70  | 106 | 110  | 120 | 0    | 5  | 10      | 15      | 30      | -<br>15 | -<br>10 | 0   |
| 03090700 | 6      | 17.4N | 137.7E | 60    | 13   | 49  | 49   | 54  | 85  | 118 | 125  | 76  | 0    | 15 | 15      | 20      | 20      | -<br>30 | 0       | 0   |
| 03090706 | 7      | 18.3N | 136.7E | 60    | 8    | 21  | 12   | 13  | 30  | 20  | 103  | 112 | 0    | 5  | 15      | 20      | -5      | -<br>30 | -<br>10 | 15  |
| 03090712 | 8      | 19.0N | 135.8E | 60    | 26   | 25  | 13   | 31  | 48  | 16  | 8    | 271 | 5    | 5  | 15      | 10      | -<br>20 | -<br>30 | -<br>10 | 20  |
| 03090718 | 9      | 19.4N | 134.8E | 65    | 12   | 13  | 13   | 25  | 21  | 44  | 96   | 133 | 0    | 5  | 15      | -<br>15 | -<br>25 | -<br>20 | -<br>20 | 10  |
| 03090800 | 10     | 19.9N | 134.0E | 70    | 8    | 18  | 16   | 33  | 38  | 73  | 62   | 207 | 0    | 5  | 0       | -<br>25 | -<br>40 | -<br>10 | -<br>30 | 10  |
| 03090806 | 11     | 20.2N | 133.0E | 70    | 16   | 13  | 19   | 33  | 33  | 126 | 50   | 235 | 0    | 5  | -<br>25 | -<br>30 | -<br>40 | -<br>20 | -<br>10 | 25  |

| 03090812 | 12 | 20.6N | 132.0E  | 75  | 12 | 25 | 43 | 41  | 55  | 51  | 181 | 416 | 0  | -5      | -<br>35 | -<br>45 | -<br>40 | -<br>20 | 0       | 30 |
|----------|----|-------|---------|-----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|----|
| 03090818 | 13 | 21.1N | 131.1E  | 75  | 12 | 25 | 18 | 25  | 56  | 60  | 333 |     | 0  | -<br>30 | -<br>35 | -<br>45 | -<br>20 | -5      | 15      |    |
| 03090900 | 14 | 21.8N | 130.3E  | 90  | 11 | 30 | 58 | 81  | 107 | 89  | 329 |     | 0  | -<br>25 | -<br>35 | -<br>30 | 0       | 0       | 10      |    |
| 03090906 | 15 | 22.4N | 129.5E  | 115 | 5  | 25 | 62 | 110 | 128 | 74  | 239 |     | 0  | -5      | -<br>20 | -5      | 0       | 15      | 25      |    |
| 03090912 | 16 | 22.9N | 128.7E  | 130 | 5  | 42 | 65 | 96  | 104 | 91  | 214 |     | 0  | -<br>10 | -<br>10 | 0       | -<br>15 | 15      | 20      |    |
| 03090918 | 17 | 23.3N | 127.8E  | 130 | 6  | 30 | 60 | 82  | 47  | 135 |     |     | 0  | -<br>10 | 5       | -<br>10 | -5      | 20      |         |    |
| 03091000 | 18 | 23.6N | 127.2E  | 150 | 5  | 23 | 57 | 48  | 30  | 192 |     |     | 0  | 0       | 10      | -<br>10 | -<br>10 | 0       |         |    |
| 03091006 | 19 | 24.0N | 126.7E  | 150 | 8  | 25 | 24 | 16  | 49  | 98  |     |     | 0  | 5       | -5      | -5      | -5      | 5       |         |    |
| 03091012 | 20 | 24.3N | 126.1E  | 150 | 0  | 30 | 43 | 48  | 49  | 125 |     |     | 0  | 15      | -<br>10 | -<br>10 | 0       | 10      |         |    |
| 03091018 | 21 | 24.7N | 125.6E  | 135 | 8  | 25 | 22 | 70  | 118 |     |     |     | 0  | -<br>10 | 0       | -5      | -<br>10 |         |         |    |
| 03091100 | 22 | 25.2N | 125.3E  | 125 | 8  | 32 | 43 | 104 | 121 |     |     |     | 5  | -<br>15 | -<br>10 | -<br>10 | -<br>15 |         |         |    |
| 03091106 | 23 | 25.9N | 125.3E  | 135 | 13 | 36 | 83 | 125 | 187 |     |     |     | 0  | 5       | 0       | 5       | 0       |         |         |    |
| 03091112 | 24 | 27.0N | 125.5E  | 135 | 13 | 60 | 87 | 114 | 154 |     |     |     | 0  | 0       | 5       | 0       | 0       |         |         |    |
| 03091118 | 25 | 28.6N | 125.8E  | 120 | 12 | 52 | 74 | 103 |     |     |     |     | 0  | 5       | -5      | 0       |         |         |         |    |
| 03091200 | 26 | 30.6N | 126.5E  | 120 | 5  | 13 | 22 | 82  |     |     |     |     | 0  | 5       | 0       | 0       |         |         |         |    |
| 03091206 | 27 | 32.7N | 127.1E  | 105 | 5  | 19 | 58 |     |     |     |     |     | 0  | -<br>10 | 0       |         |         |         |         |    |
| 03091212 | 28 | 34.8N | 128.3E  | 95  | 0  | 15 | 75 |     |     |     |     |     | -5 | -<br>15 | -5      |         |         |         |         |    |
| 03091218 | 29 | 36.9N | 129.7E  | 80  | 0  | 29 |    |     |     |     |     |     | 0  | 0       |         |         |         |         |         |    |
| 03091300 | 30 | 38.9N | 131.5E  | 75  | 12 | 45 |    |     |     |     |     |     | 0  | 5       |         |         |         |         |         |    |
| 03091306 | 31 | 40.6N | 134.7E  | 60  | 7  |    |    |     |     |     |     |     | 0  |         |         |         |         |         |         |    |
| 03091312 |    | 42.2N | 137.9E  | 55  |    |    |    |     |     |     |     |     |    |         |         |         |         |         |         |    |
|          |    |       | AVERAGE |     | 10 | 32 | 50 | 69  | 78  | 92  | 162 | 211 | 1  | 8       | 11      | 13      | 14      | 15      | 20      | 15 |
|          |    |       | BIAS    |     |    |    |    |     |     |     |     |     | 0  | -2      | -3      | -6      | -7      | -8      | -<br>11 | 5  |
|          |    |       | # CASES |     | 31 | 30 | 28 | 26  | 24  | 20  | 15  | 11  | 31 | 30      | 28      | 26      | 24      | 20      | 15      | 11 |

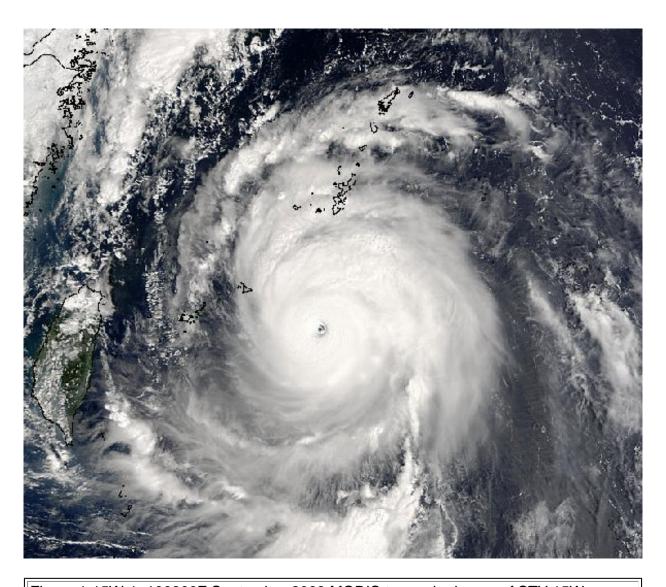


Figure 1-15W-1. 100200Z September 2003 MODIS true-color image of STY 15W (Maemi), located 330nm east of Taiwan, with a maximum intensity of 150 knots.

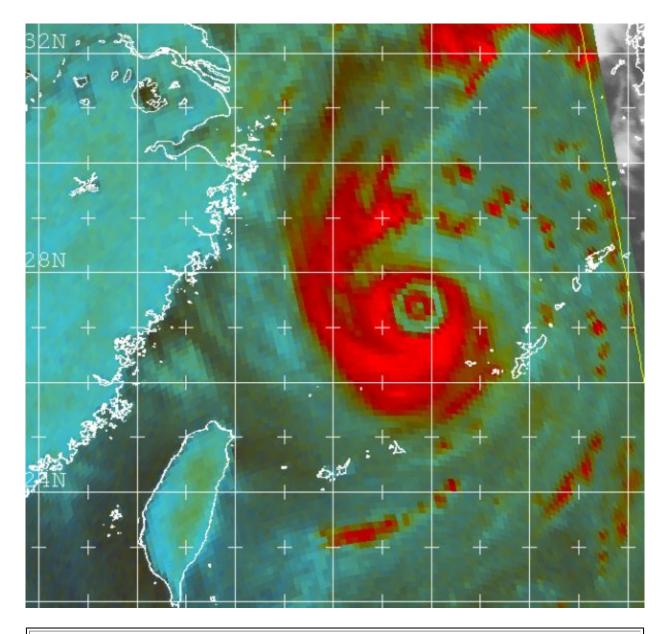


Figure 1-15W-2. 111251Z September 2003 color composite SSM/I imagery of STY 15W (Maemi), the system was undergoing a concentric eyewall cycle. located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

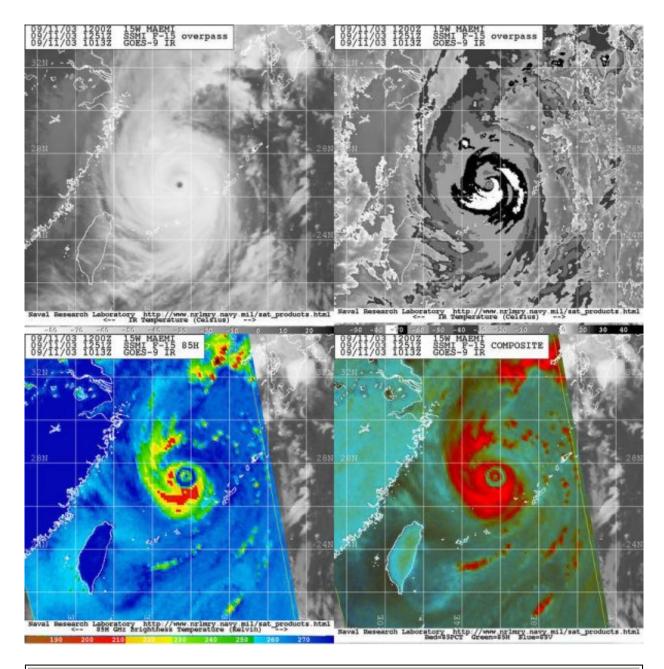
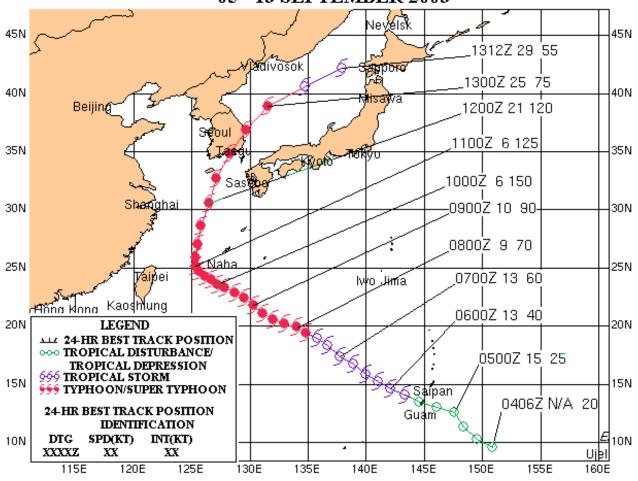
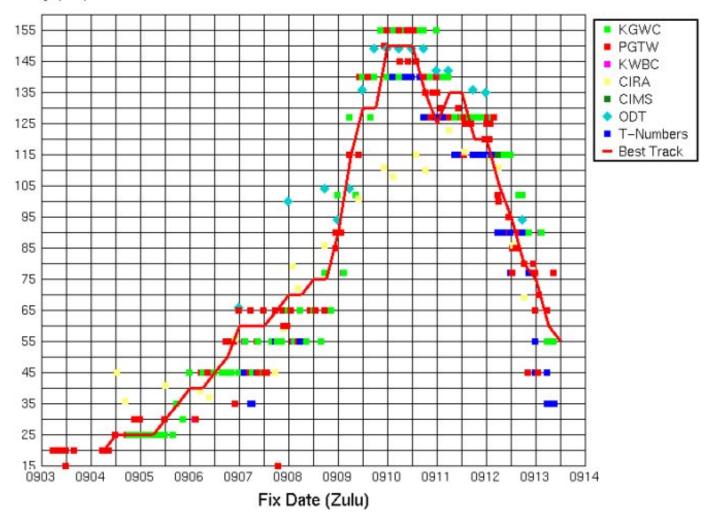


Figure 1-15W-2. 111251Z September 2003 85 GHz multi-sensor imagery of STY 15W (Maemi), located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

### SUPER TYPHOON 15W (MAEMI) 05 - 13 SEPTEMBER 2003



# Time Intensity for 15W



## Typhoon (TY) 16W (Choi-Wan)\*



First Poor: N/A

First Fair: 0130Z 17 Sep 03

First TCFA: 1300Z 17 Sep 03

First Warning: 1800Z 17 Sep 03

Last Warning: 1800Z 22 Sep 03

Max Intensity: 95 kts, gusts to 115 kts

Landfall: Okinawa, Japan

Total Warnings: 21

### Remarks:

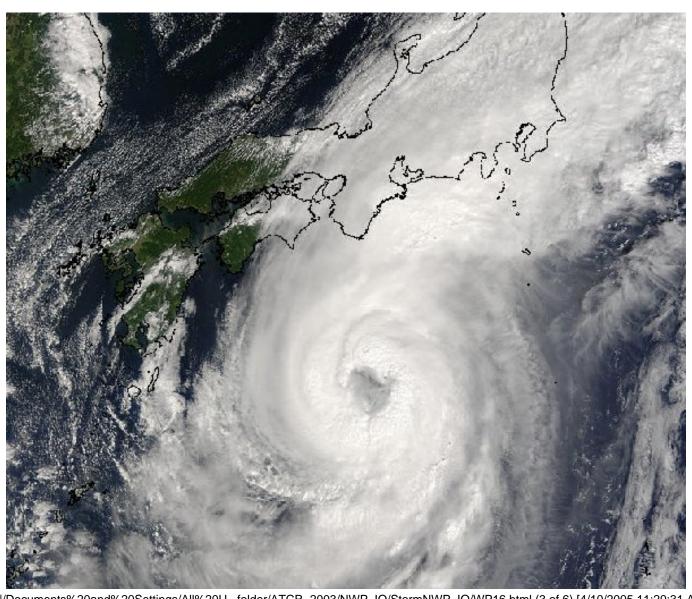
1) Typhoon (TY) 16W was first noted as a rapidly developing low level circulation in a reverse oriented monsoon trough on 17 September. Within 18 hours, a first warning was issued for this cyclone as it tracked poleward under the influence of the subtropical ridge to the east-northeast.

Once TY 16W passed the axis of the steering ridge on 19 September, the cyclone began to move more poleward while still intensifying. By 1800Z on 21 September, interaction with the mid-latitude westerlies began to weaken the cyclone as it tracked northeastward to east-northeastward while undergoing extratropical transition. Extratropical transition was complete within 24 hours and a final warning was issued.

2) No reports of significant damage are associated with this system.

|          |     |       |        | Stati | stic | s fo | r JT | wc  | on 1 | ΓΥ16 | SW . |      |         |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|------|------|-----|------|------|------|------|---------|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |       |      |      |      |     |      |      |      |      |         |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |       | PO   | SITI | ON E | RRC | DRS  |      |      |      | WI      | ND      | ER      | RO      | RS      |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00   | 12   | 24   | 36  | 48   | 72   | 96   | 120  | 00      | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03091706 |     | 19.4N | 130.4E | 15    |      |      |      |     |      |      |      |      |         |         |         |         |         |         |         |     |
| 03091712 |     | 20.0N | 129.8E | 25    |      |      |      |     |      |      |      |      |         |         |         |         |         |         |         |     |
| 03091718 | 1   | 20.7N | 129.2E | 25    | 12   | 50   | 72   | 154 | 229  | 391  | 614  | 968  | 0       | 0       | -<br>10 | -<br>10 | -<br>10 | -5      | -<br>45 | 0   |
| 03091800 | 2   | 21.4N | 128.5E | 30    | 12   | 16   | 101  | 188 | 264  | 452  | 690  | 1220 | 0       | 10      | -<br>10 | -5      | 5       | -5      | -<br>25 | 30  |
| 03091806 | 3   | 21.7N | 127.4E | 30    | 24   | 99   | 186  | 254 | 307  | 453  | 729  |      | 0       | -5      | -<br>10 | -<br>10 | 5       | -<br>15 | -<br>20 |     |
| 03091812 | 4   | 22.7N | 127.2E | 30    | 20   | 110  | 190  | 248 | 265  | 429  | 737  |      | 0       | -<br>15 | -<br>15 | -<br>10 | -5      | -<br>30 | -<br>10 |     |
| 03091818 | 5   | 23.7N | 127.5E | 45    | 8    | 79   | 149  | 211 | 247  | 432  | 761  |      | 0       | 0       | 10      | 20      | 20      | -<br>25 | -5      |     |
| 03091900 | 6   | 24.9N | 127.7E | 55    | 17   | 24   | 58   | 88  | 150  | 328  | 797  |      | 0       | 10      | 25      | 25      | 0       | -5      | 20      |     |
| 03091906 | 7   | 26.0N | 128.0E | 55    | 5    | 21   | 13   | 49  | 98   | 215  |      |      | 0       | 5       | 25      | 25      | -<br>10 | -<br>20 |         |     |
| 03091912 | 8   | 27.0N | 128.2E | 60    | 6    | 6    | 48   | 105 | 120  | 130  |      |      | 5       | 10      | 25      | 5       | -<br>15 | -<br>10 |         |     |
| 03091918 | 9   | 27.8N | 128.8E | 65    | 8    | 18   | 65   | 78  | 97   | 106  |      |      | 0       | 15      | 15      | -<br>15 | -<br>25 | -<br>10 |         |     |
| 03092000 | 10  | 28.4N | 129.7E | 65    | 6    | 45   | 79   | 94  | 99   | 184  |      |      | 0       | 10      | -5      | -<br>25 | -<br>35 | -<br>10 |         |     |
| 03092006 | 11  | 28.8N | 130.7E | 65    | 12   | 68   | 86   | 92  | 101  |      |      |      | 5       | 10      | -<br>20 | -<br>30 | -<br>35 |         |         |     |
| 03092012 | 12  | 29.0N | 132.1E | 70    | 16   | 58   | 93   | 120 | 158  |      |      |      | 0       | -<br>10 | -<br>20 | -<br>25 | -<br>25 |         |         |     |
| 03092018 | 13  | 29.4N | 133.7E | 70    | 24   | 67   | 90   | 119 | 182  |      |      |      | 5       | -<br>30 | -<br>35 | -<br>40 | -<br>25 |         |         |     |
| 03092100 | 14  | 30.0N | 135.6E | 90    | 11   | 24   | 13   | 18  | 186  |      |      |      | -5      | -<br>25 | -<br>30 | -<br>20 | -<br>10 |         |         |     |
| 03092106 | 15  | 31.1N | 137.2E | 100   | 10   | 31   | 58   | 117 |      |      |      |      | -5      | -<br>10 | -<br>10 | -5      |         |         |         |     |
| 03092112 | 16  | 32.1N | 139.0E | 100   | 15   | 30   | 53   | 226 |      |      |      |      | -5      | -<br>10 | -5      | 0       |         |         |         |     |
| 03092118 | 17  | 33.2N | 140.8E | 100   | 5    | 10   | 13   |     |      |      |      |      | -<br>10 | -<br>15 | -5      |         |         |         |         |     |
| 03092200 | 18  | 34.4N | 142.8E | 95    | 6    | 26   | 123  |     |      |      |      |      | -<br>10 | -5      | -5      |         |         |         |         |     |
|          |     |       |        |       |      |      |      |     |      |      |      |      |         |         |         |         |         |         |         |     |

| 03092206 | 19 | 35.9N | 145.0E  | 90 | 0  | 50  |    |     |     |     |     |      | -<br>10 | 0  |    |    |         |         |         |    |
|----------|----|-------|---------|----|----|-----|----|-----|-----|-----|-----|------|---------|----|----|----|---------|---------|---------|----|
| 03092212 | 20 | 37.5N | 147.7E  | 75 | 18 | 132 |    |     |     |     |     |      | -5      | 5  |    |    |         |         |         |    |
| 03092218 | 21 | 39.4N | 151.1E  | 65 | 0  |     |    |     |     |     |     |      | -5      |    |    |    |         |         |         |    |
| 03092300 |    | 42.1N | 156.5E  | 55 |    |     |    |     |     |     |     |      |         |    |    |    |         |         |         |    |
|          |    |       | AVERAGE |    | 12 | 48  | 83 | 135 | 179 | 312 | 721 | 1094 | 3       | 10 | 16 | 17 | 16      | 14      | 21      | 15 |
|          |    |       | BIAS    |    |    |     |    |     |     |     |     |      | -2      | -3 | -4 | -8 | -<br>12 | -<br>14 | -<br>14 | 15 |
|          |    |       | # CASES |    | 21 | 20  | 18 | 16  | 14  | 10  | 6   | 2    | 21      | 20 | 18 | 16 | 14      | 10      | 6       | 2  |



file:///C|/Documents%20and%20Settings/All%20U...folder/ATCR\_2003/NWP\_IO/StormNWP\_IO/WP16.html (3 of 6) [4/10/2005 11:20:31 AM]

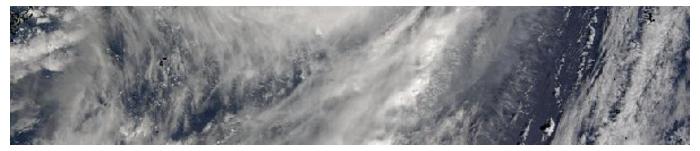


Figure 1-16W-1. 210140Z September 2003 MODIS true-color image of TY 16W (Choi-Wan), located 220nm south of Japan, with an intensity of 85 knots.

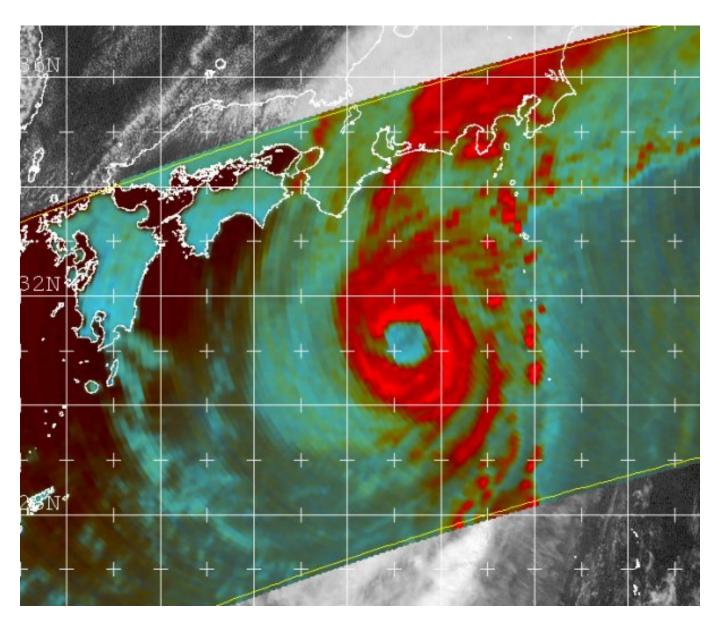
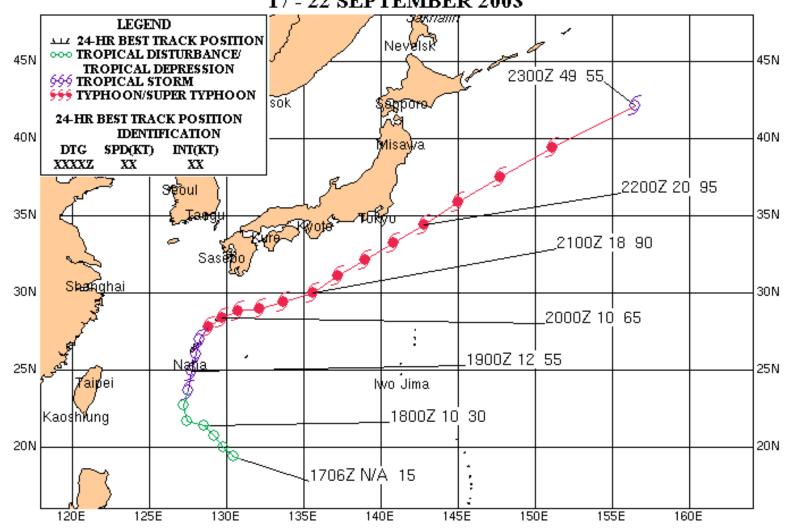
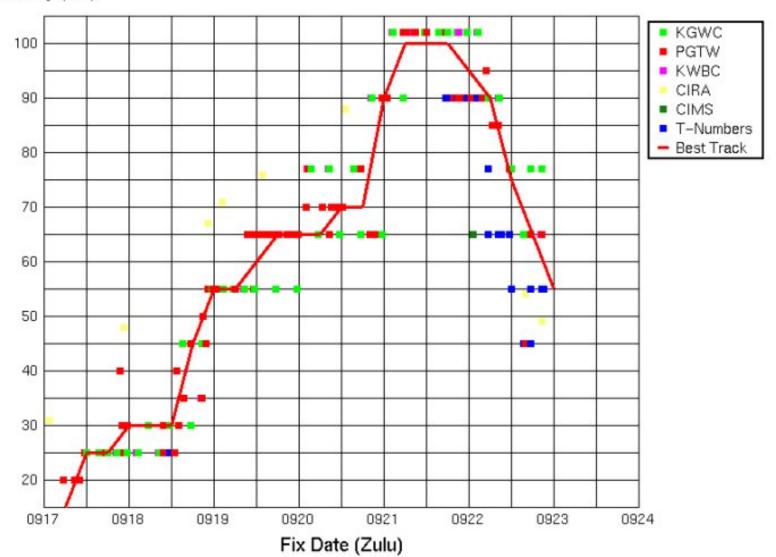


Figure 1-16W-2. 210544Z September 2003 color composite TRMM imagery of TY 16W (Choi-wan), the large eye was located 160 nm southeast mainland Japan at its peak intensity of 95 knots.

### TYPHOON 16W (CHOI-WAN) 17 - 22 SEPTEMBER 2003



# Time Intensity for 16W



### Typhoon (TY) 16W (Choi-Wan)\*



First Poor: N/A

First Fair : 0130Z 17 Sep 03

First TCFA: 1300Z 17 Sep 03

First Warning: 1800Z 17 Sep 03

Last Warning: 1800Z 22 Sep 03

Max Intensity: 95 kts, gusts to 115 kts

Landfall: Okinawa, Japan

Total Warnings: 21

#### Remarks:

1) Typhoon (TY) 16W was first noted as a rapidly developing low level circulation in a reverse oriented monsoon trough on 17 September. Within 18 hours, a first warning was issued for this cyclone as it tracked poleward under the influence of the subtropical ridge to the east-northeast.

Once TY 16W passed the axis of the steering ridge on 19 September, the cyclone began to move more poleward while still intensifying. By 1800Z on 21 September, interaction with the mid-latitude westerlies began to weaken the cyclone as it tracked northeastward to east-northeastward while undergoing extratropical transition. Extratropical transition was complete within 24 hours and a final warning was issued.

2) No reports of significant damage are associated with this system.

#### Statistics for JTWC on TY16W WRN BEST TRACK POSITION ERRORS WIND ERRORS 00 12 24 36 48 72 96 120 DTG NO. LAT LONG wind 00 12 24 36 48 72 | 96 120 03091706 19.4N 130.4E 15 20.0N 129.8E 25 03091712 10 10 10 -5 45 0 03091718 1 20.7N | 129.2E 25 12 50 72 154 229 391 614 968 $\left| 10 \right|_{10}^{-} \left| -5 \right| 5 \left| -5 \right|_{25}^{-} \left| 30 \right|$ 101 188 264 452 690 1220 0 03091800 2 21.4N | 128.5E 30 12 16 03091806 3 24 99 186 254 307 453 729 10 10 5 15 20 21.7N | 127.4E 30 03091812 4 22.7N 127.2E 30 20 110 190 248 265 429 737 0 15 15 10 -5 30 10 0 10 20 20 25 -5 8 79 149 211 247 432 761 03091818 5 23.7N | 127.5E 45 17 24 10 25 25 0 -5 20 03091900 |6 24.9N | 127.7E 150 328 797 55 58 88 5 25 25 10 20 03091906 7 26.0N 128.0E 55 5 21 13 49 98 215 0 10 25 5 03091912 | 8 27.0N 128.2E 60 6 6 48 105 120 130 15 10 15 15 15 25 10 03091918 9 27.8N 128.8E 65 8 18 65 78 97 106 10 -5 25 35 10 184 03092000 10 28.4N | 129.7E 65 6 45 79 94 99 10 20 30 35 03092006 11 28.8N 130.7E 65 12 68 92 101 86 03092012 | 12 29.0N | 132.1E 70 16 58 93 120 158 10 20 25 25 03092018 13 29.4N 133.7E 70 24 67 90 119 182 5 30 35 40 25 03092100 14 30.0N 135.6E 90 186 11 24 13 18 -5 25 30 20 10 03092106 15 31.1N 137.2E 100 10 31 58 117 10 10 -5 -5 $-5 \begin{vmatrix} -1 \\ 10 \end{vmatrix} -5 \begin{vmatrix} 0 \\ 10 \end{vmatrix}$ 03092112 16 100 15 30 32.1N 139.0E 53 226 10 15 -5 03092118 17 33.2N 140.8E 100 5 10 13

| 03092200 | 18 | 34.4N | 142.8E  | 95 | 6  | 26  | 123 |     |     |     |     |      | -<br>10 | -5 | -5 |    |         |         |         |    |
|----------|----|-------|---------|----|----|-----|-----|-----|-----|-----|-----|------|---------|----|----|----|---------|---------|---------|----|
| 03092206 | 19 | 35.9N | 145.0E  | 90 | 0  | 50  |     |     |     |     |     |      | -<br>10 | 0  |    |    |         |         |         |    |
| 03092212 | 20 | 37.5N | 147.7E  | 75 | 18 | 132 |     |     |     |     |     |      | -5      | 5  |    |    |         |         |         |    |
| 03092218 | 21 | 39.4N | 151.1E  | 65 | 0  |     |     |     |     |     |     |      | -5      |    |    |    |         |         |         |    |
| 03092300 |    | 42.1N | 156.5E  | 55 |    |     |     |     |     |     |     |      |         |    |    |    |         |         |         |    |
|          |    |       | AVERAGE |    | 12 | 48  | 83  | 135 | 179 | 312 | 721 | 1094 | 3       | 10 | 16 | 17 | 16      | 14      | 21      | 15 |
|          |    |       | BIAS    |    |    |     |     |     |     |     |     |      | -2      | -3 | -4 | -8 | -<br>12 | -<br>14 | -<br>14 | 15 |
|          |    |       | # CASES |    | 21 | 20  | 18  | 16  | 14  | 10  | 6   | 2    | 21      | 20 | 18 | 16 | 14      | 10      | 6       | 2  |

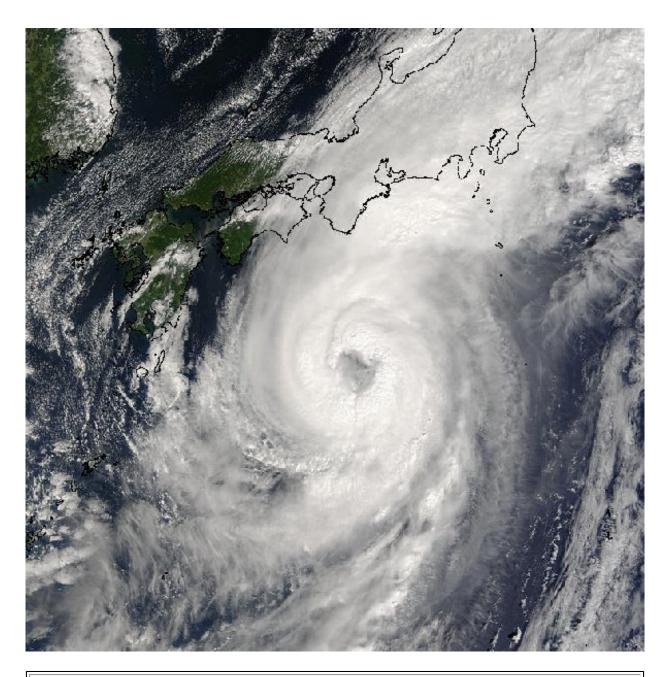


Figure 1-16W-1. 210140Z September 2003 MODIS true-color image of TY 16W (Choi-Wan), located 220nm south of Japan, with an intensity of 85 knots.

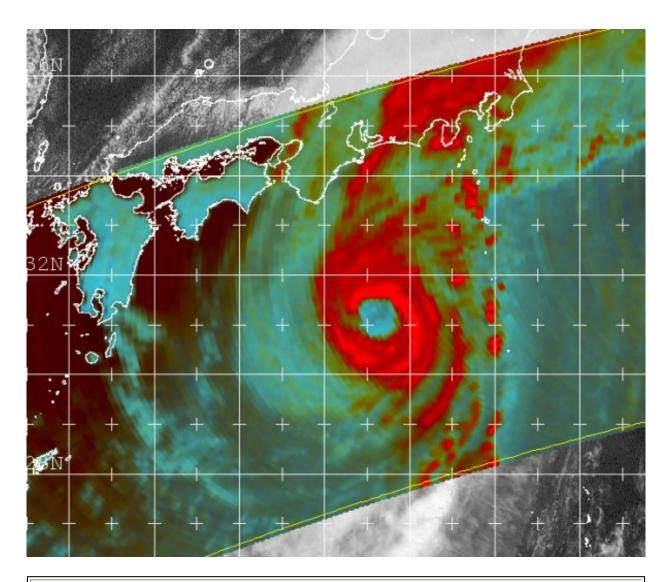
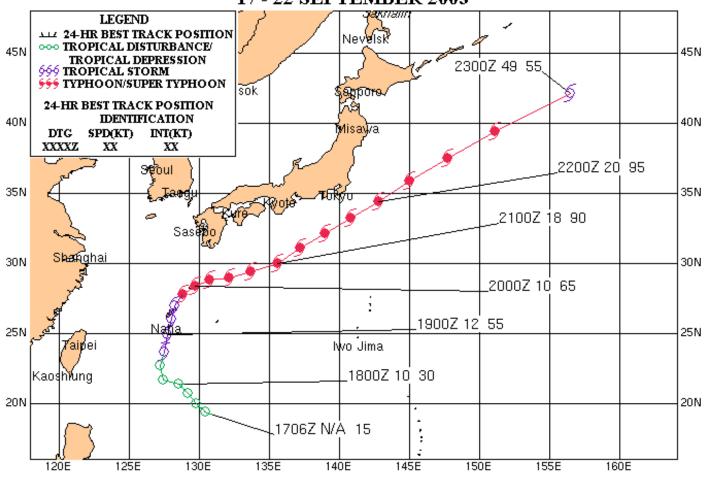
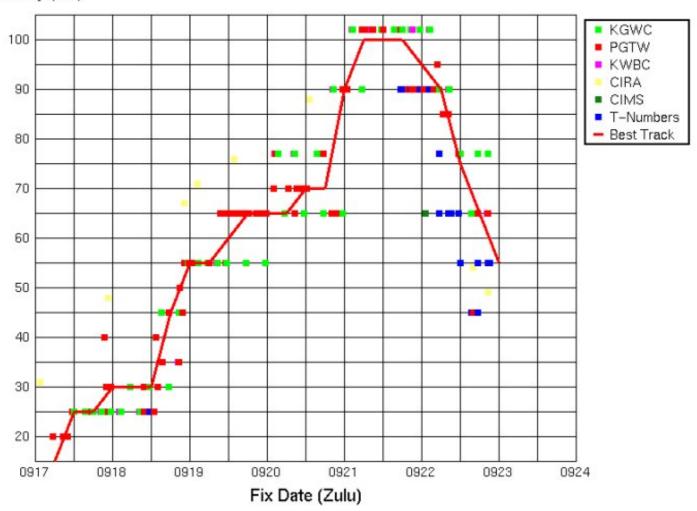


Figure 1-16W-2. 210544Z September 2003 color composite TRMM imagery of TY 16W (Choi-wan), the large eye was located 160 nm southeast mainland Japan at its peak intensity of 95 knots.

### TYPHOON 16W (CHOI-WAN) 17 - 22 SEPTEMBER 2003



## Time Intensity for 16W



## Typhoon (TY) 17W (Koppu)\*



First Poor : 0600Z 22 Sep 03

First Fair: 2130Z 23 Sep 03

First TCFA: 0230Z 24 Sep 03

First Warning: 1200Z 24 Sep 03

Last Warning: 0600Z 30 Sep 03, Extratropical

Max Intensity: 90 kts gusts to 110 kts

Landfall: None

Total Warnings: 24

### Remarks:

(1) Typhoon (TY) 11W was initially described as a disturbance developing out of a broad monsoon trough, approximately 220 NM east-northeast of Yap. The first warning was issued at 1200Z on 24 September. The cyclone initially tracked northwestward along the southern periphery of a mid-level steering ridge anchored east of Japan. Intensification of TY 17W was suppressed by a TUTT cell located to the northeast of the system that hindered upper level diffluence. This same TUTT cyclone appears to have caused the cyclone to loop before 1200Z on 25 September.

TY 17W turned to the north-northeast after 25 September in response to a shortwave trough in the midlatitude westerlies. Subsequently, the outflow from the cyclone improved due to this interaction with the shortwave trough and the dissipation of the TUTT cyclone.

After 25 September, another trough in the mid-latitude westerly flow caused the cyclone to accelerate east-northeastward and begin transition into an extratropical system. The final warning was issued at 0600Z on 30 September.

(2) No casualties or damage were reported.

|          |     |        |        | Stati | stics | s for | JTV  | VC c | n T | Y17\ | N   |     |    |         |         |         |         |         |         |     |
|----------|-----|--------|--------|-------|-------|-------|------|------|-----|------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |        |        |       |       |       |      |      |     |      |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST T | ΓRACK  |       | POS   | SITIO | N EF | RROI | RS  |      |     |     | WI | ND      | ER      | ROI     | RS      |         |         |     |
| DTG      | NO. | LAT    | LONG   | wind  | 00    | 12    | 24   | 36   | 48  | 72   | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03092318 |     | 14.5N  | 139.6E | 25    |       |       |      |      |     |      |     |     |    |         |         |         |         |         |         |     |
| 03092400 |     | 15.1N  | 138.9E | 25    |       |       |      |      |     |      |     |     |    |         |         |         |         |         |         |     |
| 03092406 |     | 15.6N  | 138.1E | 25    |       |       |      |      |     |      |     |     |    |         |         |         |         |         |         |     |
| 03092412 | 1   | 15.9N  | 137.1E | 25    | 11    | 12    | 133  | 135  | 156 | 172  | 148 | 240 | 0  | 0       | 5       | 25      | 30      | 20      | -<br>10 | -5  |
| 03092418 | 2   | 16.6N  | 136.2E | 30    | 12    | 122   | 133  | 133  | 166 | 150  |     |     | 0  | 10      | 20      | 35      | 35      | 15      |         |     |
| 03092500 | 3   | 16.6N  | 135.4E | 30    | 23    | 67    | 45   | 51   | 62  | 38   |     |     | 0  | 10      | 25      | 30      | 15      | 10      |         |     |
| 03092506 | 4   | 15.8N  | 135.6E | 30    | 42    | 47    | 52   | 90   | 115 | 140  |     |     | 0  | 10      | 25      | 25      | 5       | 20      |         |     |
| 03092512 | 5   | 16.4N  | 136.1E | 30    | 36    | 21    | 38   | 78   | 120 | 144  |     |     | 0  | 10      | 15      | 5       | 0       | 5       |         |     |
| 03092518 | 6   | 17.2N  | 136.2E | 30    | 17    | 33    | 62   | 103  | 109 | 84   |     |     | 0  | 10      | 10      | -<br>10 | 0       | -<br>15 |         |     |
| 03092600 | 7   | 17.9N  | 136.4E | 25    | 111   | 154   | 207  | 258  | 281 | 266  |     |     | 0  | 0       | -<br>15 | -<br>15 | -5      | -<br>20 |         |     |
| 03092606 | 8   | 18.5N  | 136.7E | 25    | 23    | 21    | 81   | 108  | 126 | 120  |     |     | 0  | 0       | -<br>15 | -<br>10 | -5      | -<br>25 |         |     |
| 03092612 | 9   | 19.3N  | 137.4E | 30    | 17    | 43    | 97   | 126  | 110 | 81   |     |     | 0  | -<br>10 | -<br>15 | -<br>10 | -<br>15 | -<br>20 |         |     |
| 03092618 | 10  | 20.1N  | 138.1E | 35    | 16    | 43    | 48   | 50   | 57  | 83   |     |     | -5 | -<br>20 | -<br>15 | -<br>10 | -<br>25 | -<br>10 |         |     |
| 03092700 | 11  | 21.2N  | 138.7E | 50    | 25    | 39    | 75   | 110  | 172 | 122  |     |     | 0  | -5      | 5       | 0       | -<br>10 | 10      |         |     |
| 03092706 | 12  | 22.3N  | 139.3E | 60    | 17    | 42    | 76   | 144  | 219 | 118  |     |     | 0  | 10      | 20      | 5       | -5      | 25      |         |     |
| 03092712 | 13  | 23.3N  | 139.7E | 60    | 12    | 42    | 96   | 163  | 227 |      |     |     | 0  | 5       | 0       | -<br>10 | -<br>10 |         |         |     |
| 03092718 | 14  | 24.1N  | 140.0E | 60    | 18    | 48    | 112  | 213  | 283 |      |     |     | 0  | 5       | -5      | -<br>15 | -<br>10 |         |         |     |
| 03092800 | 15  | 25.0N  | 140.3E | 60    | 0     | 34    | 95   | 182  | 139 |      |     |     | 0  | -5      | -<br>15 | -<br>25 | -<br>10 |         |         |     |
| 03092806 | 16  | 25.7N  | 140.6E | 60    | 0     | 11    | 89   | 183  | 108 |      |     |     | 0  | -<br>10 | -<br>25 | -<br>20 | 5       |         |         |     |
| 03092812 | 17  | 26.3N  | 140.9E | 70    | 26    | 28    | 103  | 119  |     |      |     |     | 0  | -5      | -<br>10 | 0       |         |         |         |     |

| 03092818 | 18 | 27.0N | 141.2E  | 80 | 24 | 32 | 71 | 72  |     |     |     |     | 0  | -<br>10 | -<br>10 | 10 |    |    |         |    |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|---------|---------|----|----|----|---------|----|
| 03092900 | 19 | 27.7N | 141.5E  | 85 | 16 | 32 | 39 |     |     |     |     |     | -5 | -<br>15 | 0       |    |    |    |         |    |
| 03092906 | 20 | 28.5N | 141.9E  | 90 | 12 | 49 | 92 |     |     |     |     |     | 0  | 5       | 20      |    |    |    |         |    |
| 03092912 | 21 | 29.4N | 142.6E  | 85 | 13 | 59 |    |     |     |     |     |     | 0  | 5       |         |    |    |    |         |    |
| 03092918 | 22 | 30.7N | 144.2E  | 75 | 16 | 64 |    |     |     |     |     |     | 0  | 15      |         |    |    |    |         |    |
| 03093000 | 23 | 32.7N | 147.1E  | 60 | 13 |    |    |     |     |     |     |     | 5  |         |         |    |    |    |         |    |
| 03093006 | 24 | 35.0N | 150.1E  | 45 | 34 |    |    |     |     |     |     |     | 0  |         |         |    |    |    |         |    |
|          |    |       | AVERAGE |    | 23 | 47 | 87 | 129 | 153 | 127 | 148 | 240 | 1  | 8       | 14      | 14 | 12 | 16 | 10      | 5  |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 0  | 1       | 1       | 1  | 0  | 1  | -<br>10 | -5 |
|          |    |       | # CASES |    | 24 | 22 | 20 | 18  | 16  | 12  | 1   | 1   | 24 | 22      | 20      | 18 | 16 | 12 | 1       | 1  |

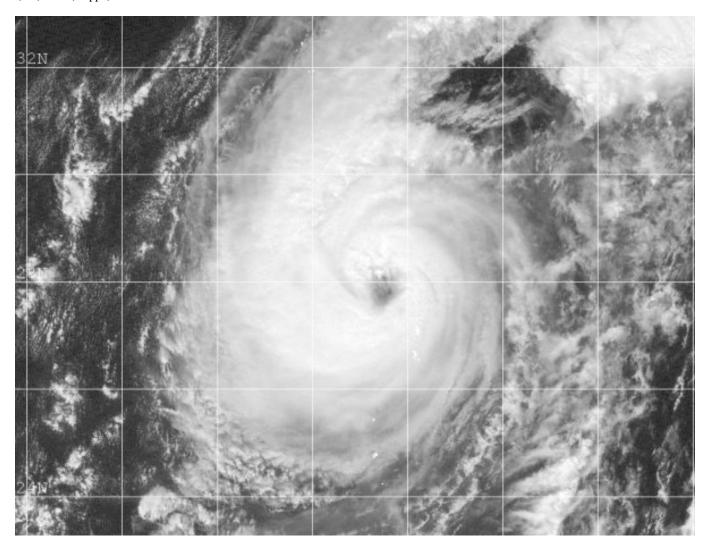


Figure 1-17W-1. 290225Z September 2003 GOES-9 visible imagery of TY 17W (Koppu), located 200 nm north-northeast of Iwo Jima island at an intensity of 80 knots.

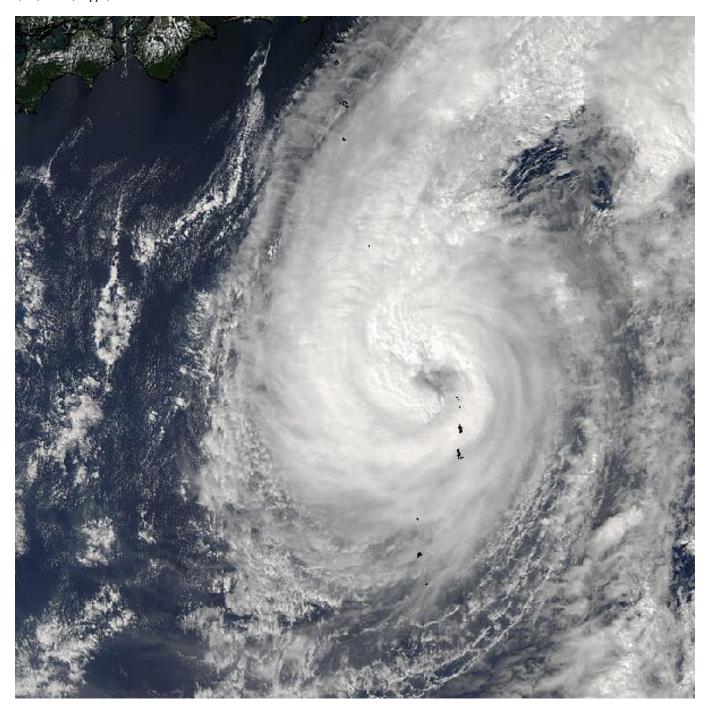
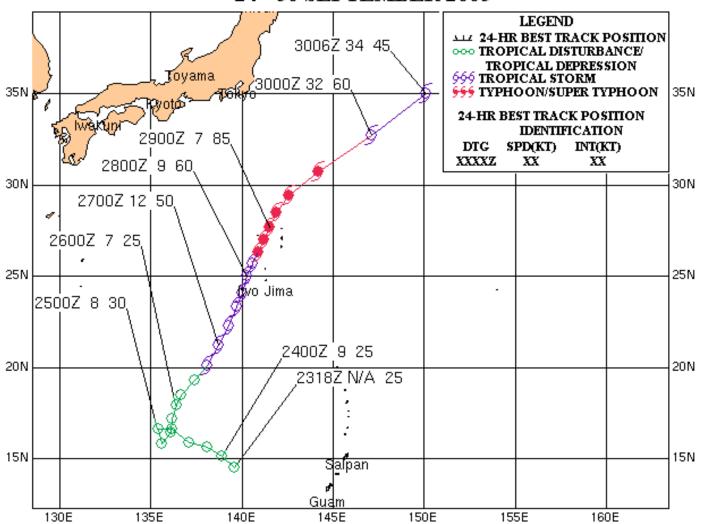
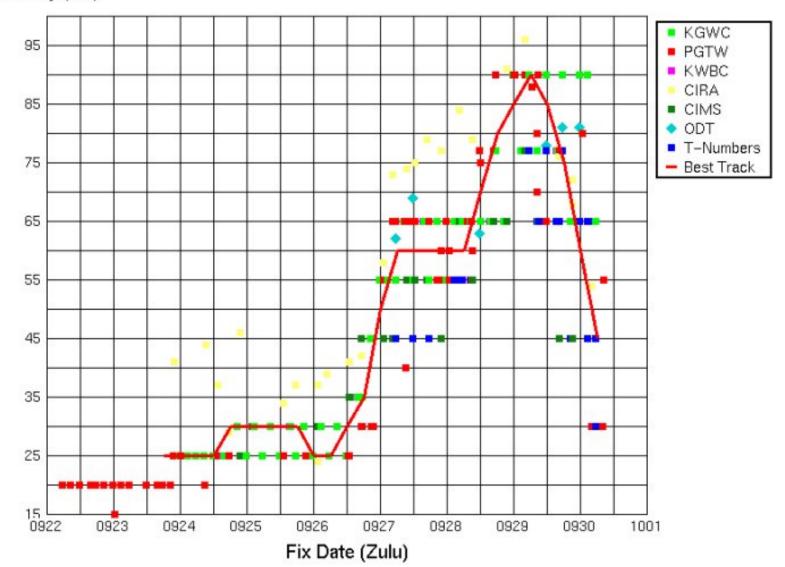


Figure 1-17W-2. 290400Z September 2003 MODIS true-color image of TY 17W (Koppu), located 210nm north of Iwo Jima, with an intensity of 90 knots.

### TYPHOON 17W (KOPPU) 24 - 30 SEPTEMBER 2003



# Time Intensity for 17W



### Typhoon (TY) 17W (Koppu)\*



First Poor : 0600Z 22 Sep 03

First Fair : 2130Z 23 Sep 03

First TCFA: 0230Z 24 Sep 03

First Warning: 1200Z 24 Sep 03

Last Warning: 0600Z 30 Sep 03, Extratropical

Max Intensity: 90 kts gusts to 110 kts

Landfall: None

Total Warnings: 24

### Remarks:

(1) Typhoon (TY) 11W was initially described as a disturbance developing out of a broad monsoon trough, approximately 220 NM east-northeast of Yap and the first warning was issued at 1200Z on 24 September. The cyclone initially tracked northwestward along the southern periphery of a mid-level steering ridge anchored east of Japan. Intensification of TY 17W was suppressed by a TUTT cell located to the northeast of the system that hindered upper level diffluence. This same TUTT cyclone appears to have caused the cyclone to loop before 1200Z on 25 September.

TY 17W turned to the north-northeast after 25 September in response to a shortwave trough in the midlatitude westerlies. Subsequently, the outflow from the cyclone improved due to this interaction with the shortwave trough and the dissipation of the TUTT cyclone.

After 25 September, another trough in the mid-latitude westerly flow caused the cyclone to accelerate east-northeastward and begin transition into an extratropical system. The final warning was issued at 0600Z on 30 September.

(2) No casualties or damage were reported.

#### Statistics for JTWC on TY17W WRN BEST TRACK POSITION ERRORS WIND ERRORS DTG NO. LAT LONG 12 24 36 72 96 120 00 12 24 36 48 72 96 120 wind 00 48 03092318 14.5N 139.6E 25 03092400 15.1N | 138.9E 25 03092406 15.6N | 138.1E 25 25 03092412 1 15.9N | 137.1E 11 12 | 133 | 135 | 156 | 172 | 148 | 240 | 0 25 30 20 10 -5 03092418 2 16.6N 136.2E 30 122 133 133 166 150 10 20 35 35 15 12 03092500 3 16.6N 135.4E 30 23 67 45 51 62 38 10 25 30 15 10 03092506 15.8N 135.6E 30 42 47 52 90 115 140 10 25 25 5 20 03092512 5 16.4N | 136.1E 30 36 21 38 78 120 144 0 10 15 5 0 5 10 10 10 0 03092518 6 17.2N 136.2E 30 17 33 62 103 109 84 15 03092600 7 17.9N 136.4E 25 15 | 15 | <sup>-5</sup> 111 | 154 | 207 | 258 | 281 | 266 0 0 20 03092606 8 18.5N 136.7E 25 23 21 81 108 126 120 0 15 10 <sup>-5</sup> 0 25 03092612 9 19.3N | 137.4E 30 43 97 126 110 81 17 0 10 15 10 15 20 03092618 10 20.1N | 138.1E 35 16 43 48 50 57 83 -5 20 15 10 25 10 03092700 11 21.2N 138.7E 50 110 172 122 25 39 75 0 -5 5 0 10 10 03092706 12 22.3N 139.3E 60 42 76 144 219 118 10 20 5 -5 25 17 03092712 13 23.3N | 139.7E 60 12 42 96 163 227 0 5 0 10 10 03092718 14 24.1N 140.0E 60 48 112 213 283 18 5 -5 15 10 03092800 15 25.0N 140.3E 60 0 34 95 182 139 0 -5 15 25 10 03092806 16 25.7N 140.6E 60 0 11 89 183 108 0 10 25 20 10 0 03092812 17 26.3N 140.9E 70 103 119 26 28 -5 24 72 03092818 18 27.0N 141.2E 80 32 71 0 10 10 10 15 0 03092900 19 27.7N | 141.5E 85 32 39 16 -5 03092906 20 28.5N 141.9E 90 12 49 92 0 5 20 03092912 21 29.4N |142.6E 85 13 |59

| 03092918 | 22 | 30.7N | 144.2E  | 75 | 16 | 64 |    |     |     |     |     |     | 0  | 15 |    |    |    |    |         |    |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|-----|----|----|----|----|----|----|---------|----|
| 03093000 | 23 | 32.7N | 147.1E  | 60 | 13 |    |    |     |     |     |     |     | 5  |    |    |    |    |    |         |    |
| 03093006 | 24 | 35.0N | 150.1E  | 45 | 34 |    |    |     |     |     |     |     | 0  |    |    |    |    |    |         |    |
|          |    |       | AVERAGE |    | 23 | 47 | 87 | 129 | 153 | 127 | 148 | 240 | 1  | 8  | 14 | 14 | 12 | 16 | 10      | 5  |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     |     | 0  | 1  | 1  | 1  | 0  | 1  | -<br>10 | -5 |
|          |    |       | # CASES |    | 24 | 22 | 20 | 18  | 16  | 12  | 1   | 1   | 24 | 22 | 20 | 18 | 16 | 12 | 1       | 1  |

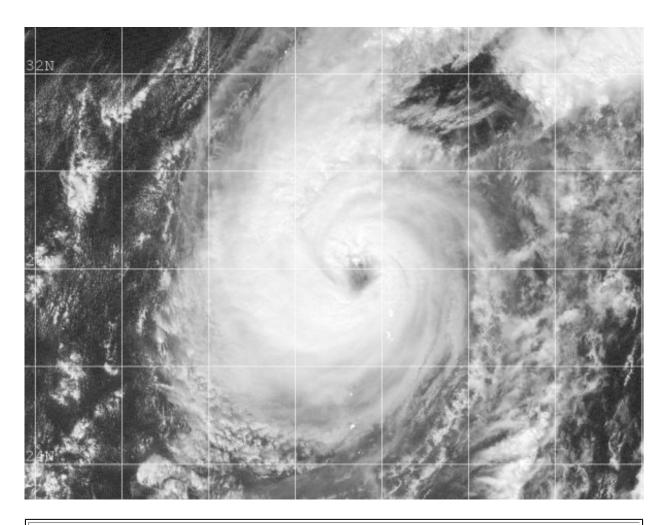


Figure 1-17W-1. 290225Z September 2003 GOES-9 visible imagery of TY 17W (Koppu), located 200 nm north-northeast of Iwo Jima island at an intensity of 80 knots.

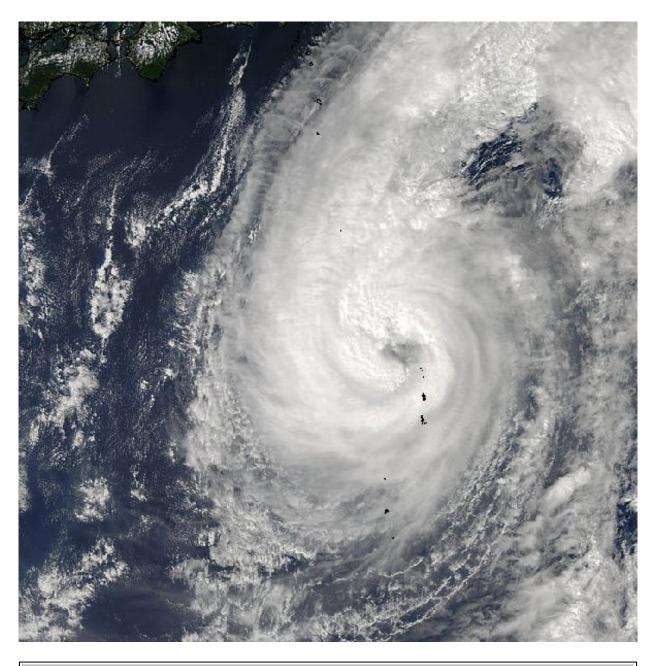
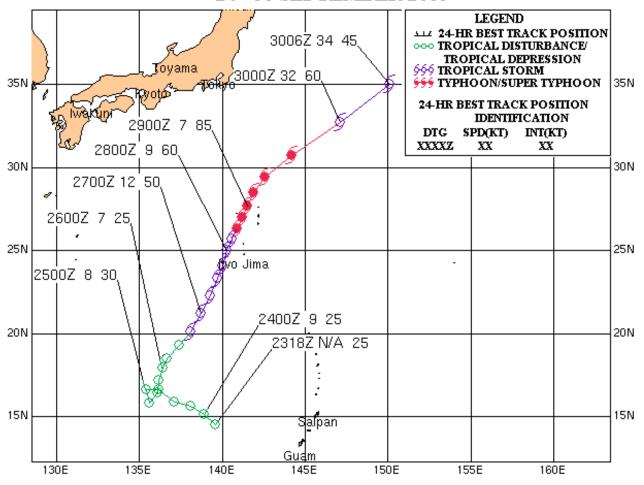
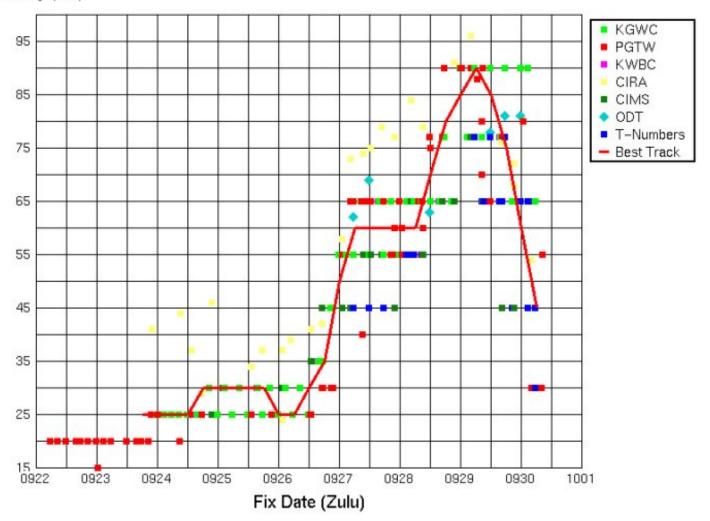


Figure 1-17W-2. 290400Z September 2003 MODIS true-color image of TY 17W (Koppu), located 210nm north of Iwo Jima, with an intensity of 90 knots.

#### TYPHOON 17W (KOPPU) 24 - 30 SEPTEMBER 2003



## Time Intensity for 17W



## **Tropical Depression (TD) 18W**



First Poor: 0600Z 06 Oct 03

First Fair: 0800Z 06 Oct 03

First TCFA: 1130Z 06 Oct 03

First Warning: 1800Z 06 Oct 03

Last Warning: 0600Z 10 Oct 03, Dissipated

Max Intensity: 25 kts, gusts to 35 kts

Landfall: None

Total Warnings: 15

- 1) Tropical Depression (TD) 18W developed and dissipated within 96 hours in the South China Sea. Weak steering flow in the region caused this cyclone to initially move southwest, then loop anticyclonically, before moving poleward toward southern China. TD 18W never exceeded 25 knots in maximum intensity and dissipated over the South China Sea just before making landfall southwest of Hong Kong.
- 2) No damage was reported in association with Tropical Depression 18W.

|          |     |        | ξ        | Statist | ics       | fo  | r JT\ | NC d | on T | D18\ | N  |     |           |     |             |     |    |    |    |     |
|----------|-----|--------|----------|---------|-----------|-----|-------|------|------|------|----|-----|-----------|-----|-------------|-----|----|----|----|-----|
|          | MON | DECT   | FD 4 O1/ |         | <b>DO</b> | OIT | 1011  |      | 200  |      |    |     | \ A / I I |     | <b>-</b> D. | 205 |    |    |    |     |
|          | WKN | BEST 1 | RACK     |         | PO        | SII | ION   | ERR  | JRS  |      |    | WII | עט        | EKI | KOF         | RS  |    |    |    |     |
| DTG      | NO. | LAT    | LONG     | wind    | 00        | 12  | 24    | 36   | 48   | 72   | 96 | 120 | 00        | 12  | 24          | 36  | 48 | 72 | 96 | 120 |
| 03100600 |     | 18.4N  | 117.6E   | 15      |           |     |       |      |      |      |    |     |           |     |             |     |    |    |    |     |
| 03100606 |     | 18.4N  | 117.1E   | 15      |           |     |       |      |      |      |    |     |           |     |             |     |    |    |    |     |

| 03100612 |    | 18.2N | 116.7E  | 15 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|--|----|----|----|----|----|----|--|
| 03100618 | 1  | 18.0N | 116.7E  | 25 | 28 | 70 | 39  | 48  | 134 | 327 |  | 0  | 10 | 15 | 20 | 20 | 30 |  |
|          | -  |       |         |    |    |    |     | -   |     |     |  | -  |    |    |    |    |    |  |
| 03100700 | 2  | 17.7N | 115.7E  | 25 | 5  | 21 | 92  | 153 | 205 | 332 |  | 0  | 10 | 15 | 20 | 20 | 30 |  |
| 03100706 | 3  | 17.3N | 115.2E  | 25 | 5  | 63 | 118 | 163 | 221 | 277 |  | 0  | 5  | 10 | 15 | 20 | 25 |  |
| 03100712 | 4  | 17.0N | 115.0E  | 25 | 12 | 91 | 142 | 186 | 250 | 281 |  | 0  | 10 | 15 | 20 | 25 | 25 |  |
| 03100718 | 5  | 17.1N | 115.3E  | 25 | 31 | 96 | 154 | 230 | 299 | 325 |  | 0  | 0  | 0  | 5  | 10 | 10 |  |
| 03100800 | 6  | 17.4N | 115.4E  | 25 | 13 | 34 | 91  | 171 | 198 | 207 |  | 0  | 0  | 0  | 5  | 5  | 5  |  |
| 03100806 | 7  | 17.7N | 115.4E  | 25 | 8  | 44 | 109 | 178 | 198 |     |  | 0  | 0  | 5  | 10 | 10 |    |  |
| 03100812 | 8  | 18.0N | 115.4E  | 25 | 17 | 49 | 111 | 148 | 152 |     |  | 0  | 0  | 5  | 10 | 15 |    |  |
| 03100818 | 9  | 18.3N | 115.3E  | 25 | 8  | 25 | 51  | 70  | 41  |     |  | 0  | 0  | 0  | 5  | 5  |    |  |
| 03100900 | 10 | 18.7N | 115.2E  | 25 | 18 | 70 | 100 | 103 | 87  |     |  | 0  | 0  | 0  | 0  | -5 |    |  |
| 03100906 | 11 | 19.1N | 115.3E  | 25 | 5  | 45 | 62  | 32  |     |     |  | 0  | 0  | 0  | -5 |    |    |  |
| 03100912 | 12 | 19.5N | 115.3E  | 25 | 8  | 13 | 25  | 74  |     |     |  | 0  | 0  | 0  | -5 |    |    |  |
| 03100918 | 13 | 19.7N | 115.2E  | 25 | 13 | 40 | 87  |     |     |     |  | 0  | 0  | 0  |    |    |    |  |
| 03101000 | 14 | 19.9N | 115.0E  | 25 | 6  | 58 | 129 |     |     |     |  | 0  | 0  | 0  |    |    |    |  |
| 03101006 | 15 | 20.2N | 114.6E  | 25 | 0  | 75 |     |     |     |     |  | 0  | -5 |    |    |    |    |  |
| 03101012 |    | 20.8N | 113.8E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
| 03101018 |    | 21.0N | 112.8E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
| 03101100 |    | 21.7N | 112.0E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
|          |    |       | AVERAGE |    | 12 | 53 | 94  | 130 | 179 | 292 |  | 0  | 3  | 5  | 10 | 14 | 21 |  |
|          |    |       | BIAS    |    |    |    |     |     |     |     |  | 0  | 2  | 5  | 8  | 13 | 21 |  |
|          |    |       | # CASES |    | 15 | 15 | 14  | 12  | 10  | 6   |  | 15 | 15 | 14 | 12 | 10 | 6  |  |

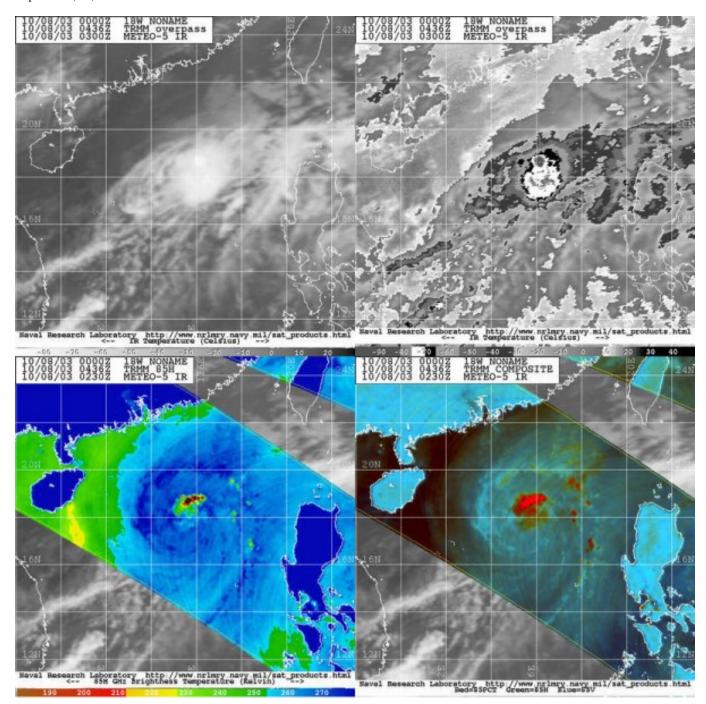
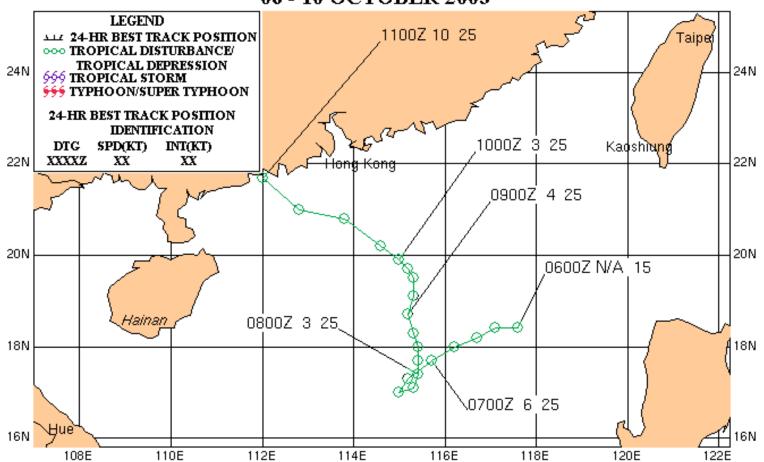
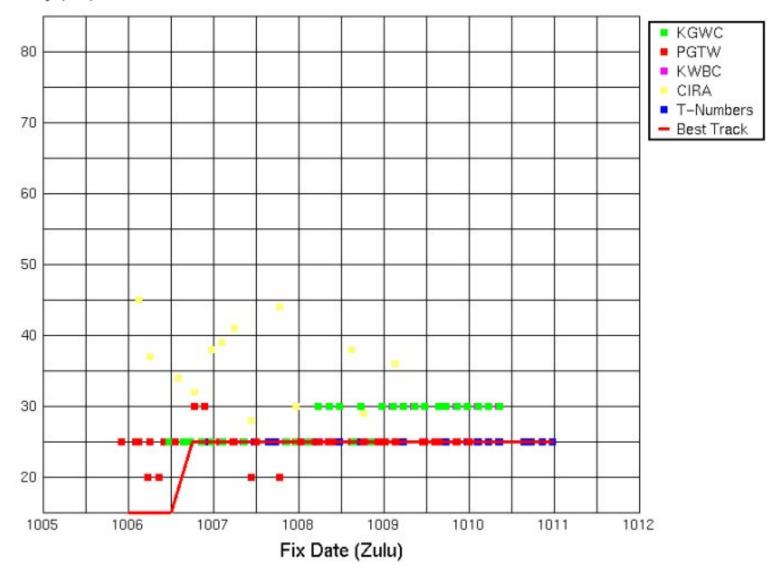


Figure 1-18W-1. 080436Z October 2003 multi-sensor satellite imagery of TY 18W, the partially exposed low level circulation center was located in the south china sea 295 nm east of Hainan island at its peak intensity of 25 knots.

### TROPICAL DEPRESSION 18W 06 - 10 OCTOBER 2003



## Time Intensity for 18W



## **Tropical Depression (TD) 18W**



First Poor: 0600Z 06 Oct 03

First Fair: 0800Z 06 Oct 03

First TCFA: 1130Z 06 Oct 03

First Warning: 1800Z 06 Oct 03

Last Warning: 0600Z 10 Oct 03, Dissipated

Max Intensity: 25 kts, gusts to 35 kts

Landfall: None

Total Warnings: 15

- 1) Tropical Depression (TD) 18W developed and dissipated within 96 hours in the South China Sea. Weak steering flow in the region caused this cyclone to initially move southwest, then loop anticyclonically, before moving poleward toward southern China. TD 18W never exceeded 25 knots in maximum intensity and dissipated over the South China Sea just before making landfall southwest of Hong Kong.
- 2) No damage was reported in association with Tropical Depression 18W.

|          |     |        | S      | tatist | ics | fo  | r JT\ | WC ( | on T | D18\ | N  |     |     |    |     |     |    |    |    |     |
|----------|-----|--------|--------|--------|-----|-----|-------|------|------|------|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     |        |        |        |     |     |       |      |      |      |    |     |     |    |     |     |    |    |    |     |
|          | WRN | BEST 1 | TRACK  |        | РО  | SIT | ION   | ERR  | ORS  |      |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00  | 12  | 24    | 36   | 48   | 72   | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03100600 |     | 18.4N  | 117.6E | 15     |     |     |       |      |      |      |    |     |     |    |     |     |    |    |    |     |
| 03100606 |     | 18.4N  | 117.1E | 15     |     |     |       |      |      |      |    |     |     |    |     |     |    |    |    |     |
| 03100612 |     | 18.2N  | 116.7E | 15     |     |     |       |      |      |      |    |     |     |    |     |     |    |    |    |     |

| 03100618 | 1  | 18.0N | 116.2E  | 25 | 28 | 70 | 39  | 48  | 134 | 327 |  | 0  | 10 | 15 | 20 | 20 | 30 |  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|--|----|----|----|----|----|----|--|
| 03100700 | 2  | 17.7N | 115.7E  | 25 | 5  | 21 | 92  | 153 | 205 | 332 |  | 0  | 10 | 15 | 20 | 20 | 30 |  |
| 03100706 | 3  | 17.3N | 115.2E  | 25 | 5  | 63 | 118 | 163 | 221 | 277 |  | 0  | 5  | 10 | 15 | 20 | 25 |  |
| 03100712 | 4  | 17.0N | 115.0E  | 25 | 12 | 91 | 142 | 186 | 250 | 281 |  | 0  | 10 | 15 | 20 | 25 | 25 |  |
| 03100718 | 5  | 17.1N | 115.3E  | 25 | 31 | 96 | 154 | 230 | 299 | 325 |  | 0  | 0  | 0  | 5  | 10 | 10 |  |
| 03100800 | 6  | 17.4N | 115.4E  | 25 | 13 | 34 | 91  | 171 | 198 | 207 |  | 0  | 0  | 0  | 5  | 5  | 5  |  |
| 03100806 | 7  | 17.7N | 115.4E  | 25 | 8  | 44 | 109 | 178 | 198 |     |  | 0  | 0  | 5  | 10 | 10 |    |  |
| 03100812 | 8  | 18.0N | 115.4E  | 25 | 17 | 49 | 111 | 148 | 152 |     |  | 0  | 0  | 5  | 10 | 15 |    |  |
| 03100818 | 9  | 18.3N | 115.3E  | 25 | 8  | 25 | 51  | 70  | 41  |     |  | 0  | 0  | 0  | 5  | 5  |    |  |
| 03100900 | 10 | 18.7N | 115.2E  | 25 | 18 | 70 | 100 | 103 | 87  |     |  | 0  | 0  | 0  | 0  | -5 |    |  |
| 03100906 | 11 | 19.1N | 115.3E  | 25 | 5  | 45 | 62  | 32  |     |     |  | 0  | 0  | 0  | -5 |    |    |  |
| 03100912 | 12 | 19.5N | 115.3E  | 25 | 8  | 13 | 25  | 74  |     |     |  | 0  | 0  | 0  | -5 |    |    |  |
| 03100918 | 13 | 19.7N | 115.2E  | 25 | 13 | 40 | 87  |     |     |     |  | 0  | 0  | 0  |    |    |    |  |
| 03101000 | 14 | 19.9N | 115.0E  | 25 | 6  | 58 | 129 |     |     |     |  | 0  | 0  | 0  |    |    |    |  |
| 03101006 | 15 | 20.2N | 114.6E  | 25 | 0  | 75 |     |     |     |     |  | 0  | -5 |    |    |    |    |  |
| 03101012 |    | 20.8N | 113.8E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
| 03101018 |    | 21.0N | 112.8E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
| 03101100 |    | 21.7N | 112.0E  | 25 |    |    |     |     |     |     |  |    |    |    |    |    |    |  |
|          |    |       | AVERAGE |    | 12 | 53 | 94  | 130 | 179 | 292 |  | 0  | 3  | 5  | 10 | 14 | 21 |  |
|          |    |       | BIAS    |    |    |    |     |     |     |     |  | 0  | 2  | 5  | 8  | 13 | 21 |  |
|          |    |       | # CASES |    | 15 | 15 | 14  | 12  | 10  | 6   |  | 15 | 15 | 14 | 12 | 10 | 6  |  |

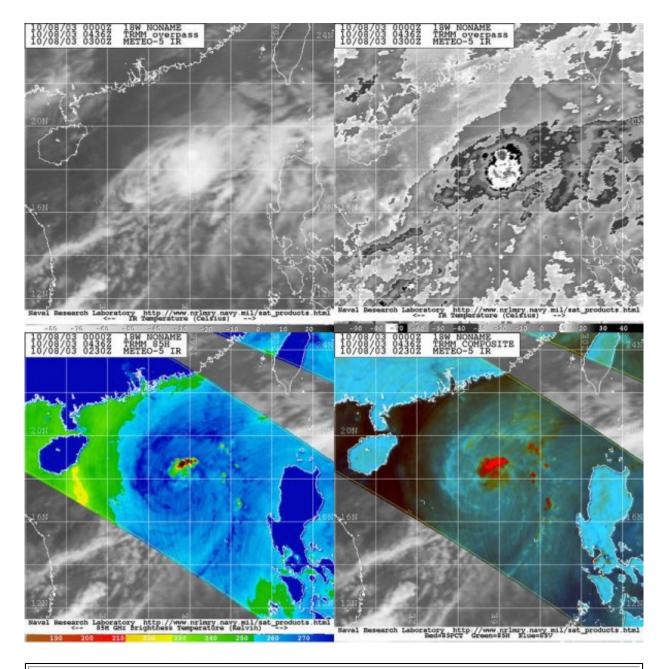
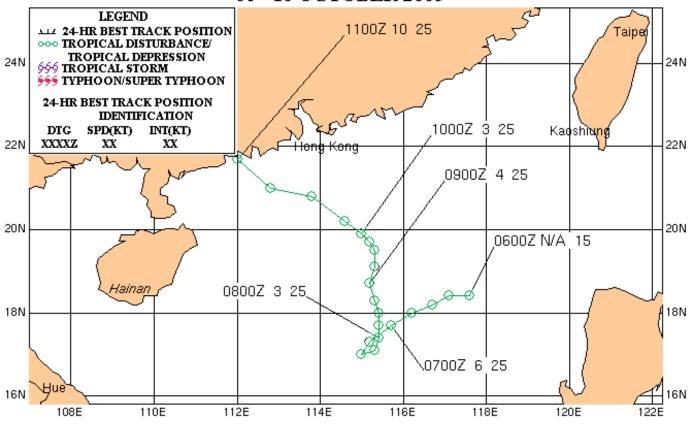
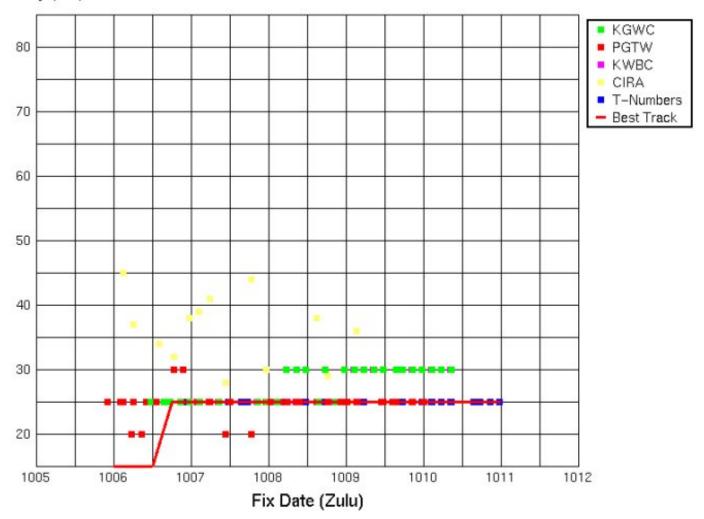


Figure 1-18W-1. 080436Z October 2003 multi-sensor satellite imagery of TY 18W, the partially exposed low level circulation center was located in the south china sea 295 nm east of Hainan island at its peak intensity of 25 knots.

# TROPICAL DEPRESSION 18W 06 - 10 OCTOBER 2003



## Time Intensity for 18W



## **Tropical Depression (TD) 19W**



First Poor: N/A

First Fair: 0330Z 10 Oct 03

First TCFA: 0200Z 12 Oct 03

First Warning: 0000Z 12 Oct 03

Last Warning: 0000Z 13 Oct 03, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: Multiple events, Kyushu and Honshu, Japan

Total Warnings: 5

- 1) Tropical Depression (TD) 19W was first noted as a disturbance on 09 October, east of Okinawa, and was monitored as a suspect area for about 48 hours before the first warning was issued. The cyclone moved slowly poleward toward Kyushu while intensifying. TD 19W reached maximum intensity of 30 knots while east of Ryukyu Island around 1800Z on 10 October. The cyclone maintained maximum intensity of 30 knots while moving over Kyushu on a northeastward heading, then dissipated over the Kii peninsula on 13 October.
- 2) No reports of damage were received for this cyclone.

|          |  |       | St        | atisti | cs fo | or JT | WC | or | ı TI | D19 | W  |     |    |    |    |    |    |    |    |     |
|----------|--|-------|-----------|--------|-------|-------|----|----|------|-----|----|-----|----|----|----|----|----|----|----|-----|
|          | WRN BEST TRACK POSITION ERRORS WIND ERRORS |       |           |        |       |       |    |    |      |     |    |     |    |    |    |    |    |    |    |     |
| DTG      | NO.  | LAT   | LONG      | wind   | 00    | 12    | 24 | 36 | 48   | 72  | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101000 |  | 25.7N | 130.7E 25 |        |       |       |    |    |      |     |    |     |    |    |    |    |    |    |    |     |

|          |   |       |           |    |     |     | <br> | <br> |    |    |    | <br> | <br> | <br> |
|----------|---|-------|-----------|----|-----|-----|------|------|----|----|----|------|------|------|
| 03101006 |   | 25.9N | 131.0E 25 |    |     |     |      |      |    |    |    |      |      |      |
| 03101012 |   | 26.2N | 131.3E 25 |    |     |     |      |      |    |    |    |      |      |      |
| 03101018 |   | 26.9N | 131.5E 30 |    |     |     |      |      |    |    |    |      |      |      |
| 03101100 |   | 27.7N | 131.1E 30 |    |     |     |      |      |    |    |    |      |      |      |
| 03101106 |   | 28.4N | 130.5E 25 |    |     |     |      |      |    |    |    |      |      |      |
| 03101112 |   | 29.1N | 129.8E 30 |    |     |     |      |      |    |    |    |      |      |      |
| 03101118 |   | 29.6N | 129.6E 30 |    |     |     |      |      |    |    |    |      |      |      |
| 03101200 | 1 | 30.3N | 129.8E 30 | 13 | 109 | 245 |      |      | -5 | 0  | -5 |      |      |      |
| 03101206 | 2 | 31.1N | 130.1E 30 | 7  | 32  |     |      |      | 0  | 0  |    |      |      |      |
| 03101212 | 3 | 32.1N | 131.5E 30 | 0  | 5   |     |      |      | 0  | -5 |    |      |      |      |
| 03101218 | 4 | 33.0N | 133.5E 30 | 16 |     |     |      |      | 0  |    |    |      |      |      |
| 03101300 | 5 | 34.0N | 135.8E 30 | 0  |     |     |      |      | -5 |    |    |      |      |      |
|          |   |       | AVERAGE   | 7  | 49  | 245 |      |      | 2  | 2  | 5  |      |      |      |
|          |   |       | BIAS      |    |     |     |      |      | -2 | -2 | -5 |      |      |      |
|          |   |       | # CASES   | 5  | 3   | 1   |      |      | 5  | 3  | 1  |      |      |      |

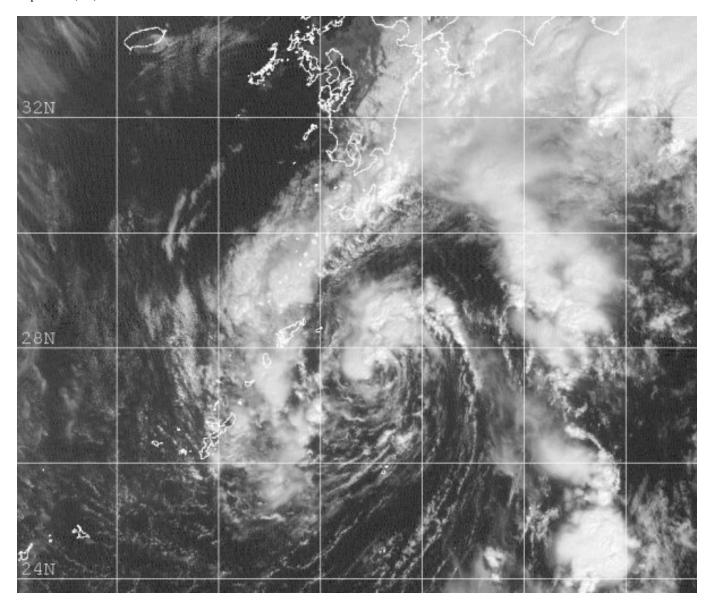
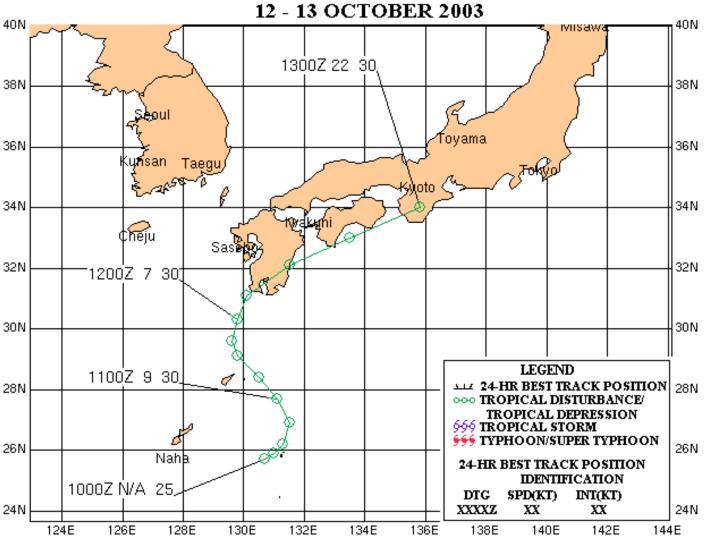
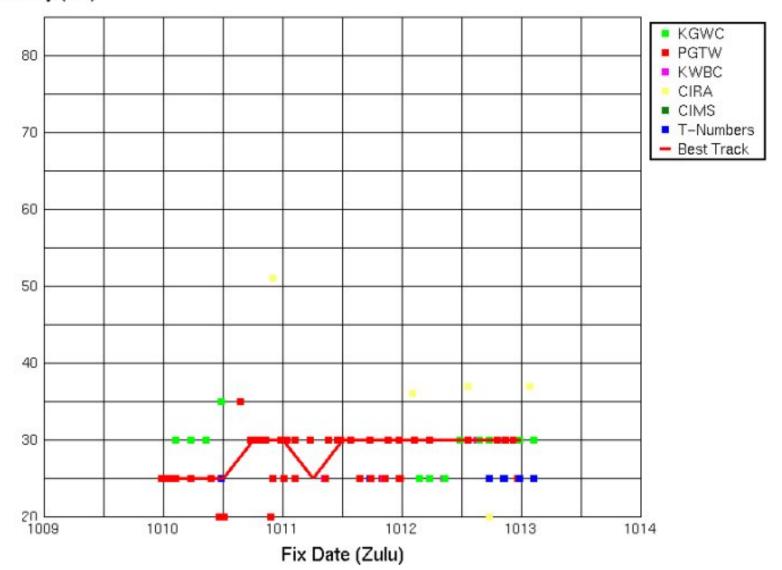


Figure 1-19W-1. 110125Z October 2003 Goes-9 visible satellite imagery of TY 19W, the partially exposed low level circulation center was located 175 nm northeast of Okinawa, Japan at its peak intensity of 30 knots.

## TROPICAL DEPRESSION 19W



## Time Intensity for 19W



## **Tropical Depression (TD) 19W**



First Poor: N/A

First Fair: 0330Z 10 Oct 03

First TCFA: 0200Z 12 Oct 03

First Warning: 0000Z 12 Oct 03

Last Warning: 0000Z 13 Oct 03, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: Multiple events, Kyushu and Honshu, Japan

Total Warnings: 5

- 1) Tropical Depression (TD) 19W was first noted as a disturbance on 09 October, east of Okinawa, and was monitored as a suspect area for about 48 hours before the first warning was issued. The cyclone moved slowly poleward toward Kyushu while intensifying. TD 19W reached maximum intensity of 30 knots while east of Ryukyu Island around 1800Z on 10 October. The cyclone maintained maximum intensity of 30 knots while moving over Kyushu on a northeastward heading, then dissipated over the Kii peninsula on 13 October.
- 2) No reports of damage were received for this cyclone.

|          |     |        | St        | atisti | cs fo | or JT | TW( | or  | n TI | D19 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|--------|-----------|--------|-------|-------|-----|-----|------|-----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     |        |           |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
|          | WRN | BEST T | RACK      |        | POS   | OITI  | ΝE  | RRC | DRS  | 3   |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG      | wind   | 00    | 12    | 24  | 36  | 48   | 72  | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03101000 |     | 25.7N  | 130.7E 25 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101006 |     | 25.9N  | 131.0E 25 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101012 |     | 26.2N  | 131.3E 25 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101018 |     | 26.9N  | 131.5E 30 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101100 |     | 27.7N  | 131.1E 30 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101106 |     | 28.4N  | 130.5E 25 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101112 |     | 29.1N  | 129.8E 30 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101118 |     | 29.6N  | 129.6E 30 |        |       |       |     |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03101200 | 1   | 30.3N  | 129.8E 30 | 13     | 109   | 245   |     |     |      |     |    | -5  | 0   | -5 |     |     |    |    |    |     |
| 03101206 | 2   | 31.1N  | 130.1E 30 | 7      | 32    |       |     |     |      |     |    | 0   | 0   |    |     |     |    |    |    |     |
| 03101212 | 3   | 32.1N  | 131.5E 30 | 0      | 5     |       |     |     |      |     |    | 0   | -5  |    |     |     |    |    |    |     |
| 03101218 | 4   | 33.0N  | 133.5E 30 | 16     |       |       |     |     |      |     |    | 0   |     |    |     |     |    |    |    |     |
| 03101300 | 5   | 34.0N  | 135.8E 30 | 0      |       |       |     |     |      |     |    | -5  |     |    |     |     |    |    |    |     |
|          |     |        | AVERAGE   | 7      | 49    | 245   |     |     |      |     |    | 2   | 2   | 5  |     |     |    |    |    |     |
|          |     |        | BIAS      |        |       |       |     |     |      |     |    | -2  | -2  | -5 |     |     |    |    |    |     |
|          |     |        | # CASES   | 5      | 3     | 1     |     |     |      |     |    | 5   | 3   | 1  |     |     |    |    |    |     |

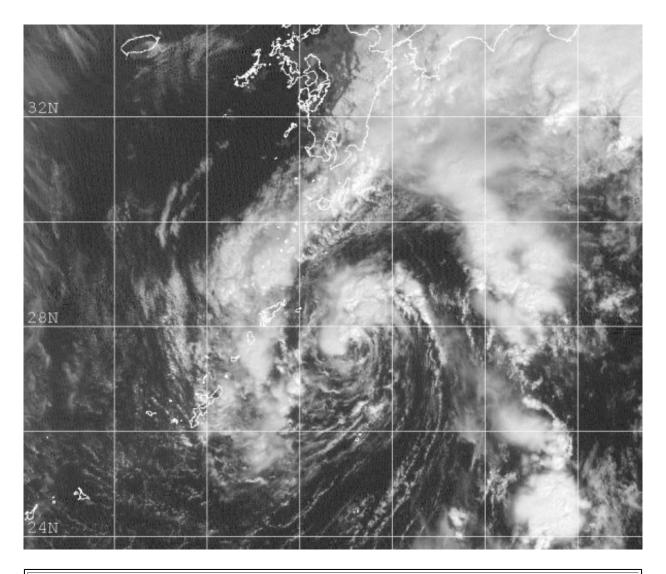
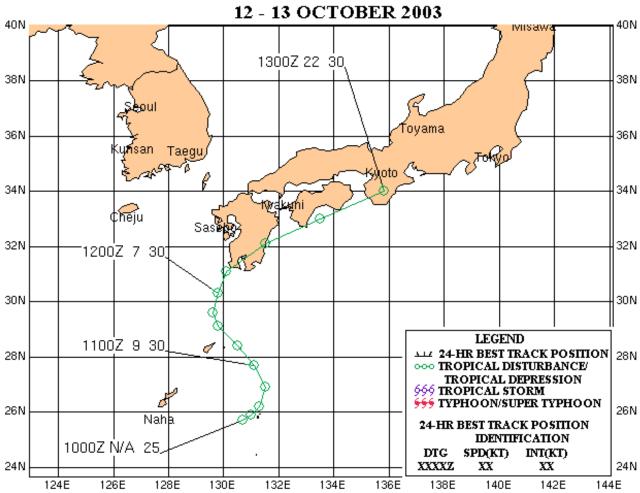
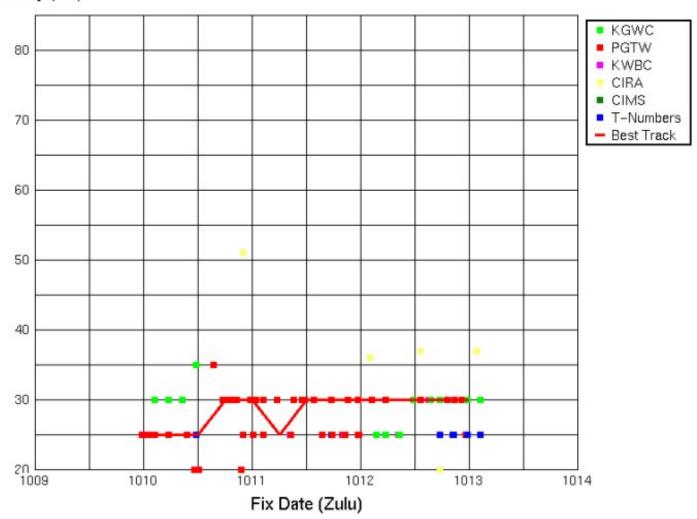


Figure 1-19W-1. 110125Z October 2003 Goes-9 visible satellite imagery of TY 19W, the partially exposed low level circulation center was located 175 nm northeast of Okinawa, Japan at its peak intensity of 30 knots.

### TROPICAL DEPRESSION 19W



## Time Intensity for 19W



## Typhoon (TY) 20W (Ketsana)\*



First Poor: 0600Z 15 Oct 03

First Fair: 0930Z 18 Oct 03

First TCFA: 1300Z 18 Oct 03

First Warning: 1800Z 18 Oct 03

Last Warning: 0000Z 26 Oct 03, Extratropical

Max Intensity: 125kts

Landfall: None

Total Warnings: 30

#### Remarks:

1) Typhoon (TY) 20W was first detected as a tropical disturbance approximately 700 NM east of Luzon Island around 0600Z on 15 October and was monitored for approximately 84 hours before first warning was issued. Of note was the near simultaneous development of TY 21W in the Northern Marianas Islands during the development of TY 20W. First warning for TY 21W was issued some 18 hours after the initial warning on TY 20W.

Development for TY 20W was noted as being initially slow, with abrupt consolidation less than 10 hours after being determined a fair suspect area with subsequent issuance of the first warning. Movement of this cyclone was initially very slow as it was located south of a weakness in the subtropical ridge.

The cyclone reached typhoon strength around 1200Z on 20 October due to dual channel upper level poleward and equatorward outflow. The continued weak steering flow caused TY 20W to move slowly poleward as it rapidly intensified over the next 24 hours to maximum intensity of 125 knots by 1200Z on 21 October. This rapid intensification phase (3.0 Dvorak T-numbers in 36 hours) ended after this time and the cyclone began shifting to a more northeastward track temporarily while slightly weakening.

By 1200Z on 23 October, TY 20W began to move more northeastward, pass the ridge axis increase track speed to 17 knots due to interaction with the mid-latitude westerlies. Vertical wind shear also increased and extratropical transition commenced. A pronounced dry slot was noted in microwave imagery by 1800Z on 24 October, with an extratropical final warning was issued at 0000Z on 26 October.

2) No damage reports were received for this cyclone.

|          |     |       |        | Stati | stic | cs f | or J | TWC | on  | TY2      | 20W |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|------|------|-----|-----|----------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |       |      |      |      |     |     |          |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |       | PC   | SIT  | ION  | ERR | ORS | <b>3</b> |     |     | WI | ND      | ERF     | ROR     | S       |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  |      |      |      | 36  | 48  | 72       | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03101812 |     | 14.7N | 130.3E | 25    |      |      |      |     |     |          |     |     |    |         |         |         |         |         |         |     |
| 03101818 | 1   | 14.9N | 130.2E | 30    | 13   | 42   | 76   | 114 | 133 | 158      |     |     | 0  | -5      | -5      | -<br>10 | -<br>30 | -<br>65 |         |     |
| 03101900 | 2   | 15.2N | 130.2E | 35    | 25   | 6    | 26   | 42  | 45  | 80       | 87  | 73  | 0  | 0       | 0       | -5      | -<br>25 | -<br>50 | -<br>30 | -10 |
| 03101906 | 3   | 15.3N | 130.3E | 40    | 11   | 29   | 41   | 17  | 21  | 122      | 177 | 262 | 0  | 5       | 0       | -<br>15 | -<br>45 | -<br>45 | -<br>15 | 0   |
| 03101912 | 4   | 15.4N | 130.4E | 40    | 11   | 21   | 26   | 6   | 49  | 130      | 184 | 301 | 0  | -5      | -<br>15 | -<br>35 | -<br>60 | -<br>55 | -<br>25 | -5  |
| 03101918 | 5   | 15.5N | 130.6E | 45    | 18   | 40   | 36   | 48  | 79  | 110      | 210 | 305 | 0  | -5      | -<br>20 | -<br>50 | -<br>55 | -<br>40 | -<br>20 | -5  |
| 03102000 | 6   | 15.6N | 130.8E | 50    | 17   | 25   | 33   | 71  | 111 | 201      | 281 | 259 | 0  | -<br>10 | 30      | -<br>50 | -<br>40 | -<br>20 | -<br>20 | -15 |
| 03102006 | 7   | 15.7N | 131.0E | 55    | 11   | 12   | 12   | 26  | 55  | 56       | 111 | 49  | 0  | -<br>20 | -<br>45 | -<br>50 | -<br>40 | -<br>15 | -5      | -10 |
| 03102012 | 8   | 15.9N | 131.0E | 65    | 5    | 12   | 29   | 52  | 69  | 41       | 98  | 17  | 0  | -<br>25 | -<br>45 | -<br>35 | 30      | -<br>15 | -5      | -10 |
| 03102018 | 9   | 16.2N | 131.0E | 80    | 0    | 0    | 24   | 60  | 90  | 127      | 267 | 129 | 0  | -<br>20 | -<br>15 | 10      | 5       | 5       | -5      | -10 |
| 03102100 | 10  | 16.4N | 131.1E | 95    | 6    | 21   | 50   | 82  | 120 | 233      | 307 | 192 | 0  | -<br>15 | -5      | 0       | 15      | 5       | -5      | -15 |
| 03102106 | 11  | 16.6N | 131.2E | 115   | 0    | 13   | 36   | 46  | 78  | 165      | 228 | 152 | 5  | 5       | 15      | 25      | 30      | 25      | 0       | -20 |
| 03102112 | 12  | 16.8N | 131.1E | 125   | 18   | 27   | 33   | 40  | 64  | 159      | 233 | 150 | 0  | 10      | 15      | 25      | 25      | 20      | -5      | -20 |
| 03102118 | 13  | 17.1N | 131.1E | 125   | 8    | 13   | 19   | 56  | 70  | 121      | 121 |     | 0  | 5       | 20      | 20      | 15      | 5       | -5      |     |
| 03102200 | 14  | 17.4N | 131.1E | 125   | 5    | 11   | 12   | 29  | 54  | 115      | 140 |     | 0  | 5       | 10      | 5       | -5      | -<br>10 | -<br>15 |     |
| 03102206 | 15  | 17.8N | 131.1E | 125   | 8    | 24   | 23   | 23  | 19  | 94       | 440 |     | 0  | 15      | 20      | 10      | 5       | -5      | -<br>15 |     |
| 03102212 | 16  | 18.2N | 131.3E | 125   | 8    | 25   | 27   | 32  | 30  | 173      | 498 |     | 0  | 5       | 0       | -5      | -5      | -<br>20 | 30      |     |

| 03102218 | 17 | 18.5N | 131.7E  | 115 | 6  | 31 | 30  | 34  | 24  | 222 |     |     | 0  | 0       | 0       | -<br>10 | -<br>10 | -<br>15 |         |     |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03102300 | 18 | 18.7N | 132.1E  | 110 | 18 | 31 | 43  | 67  | 86  | 309 |     |     | 0  | 0       | 0       | -5      | -<br>15 | -<br>15 |         |     |
| 03102306 | 19 | 19.0N | 132.4E  | 105 | 5  | 19 | 26  | 55  | 98  | 407 |     |     | 0  | 5       | 5       | 0       | -5      | -<br>10 |         |     |
| 03102312 | 20 | 19.5N | 132.8E  | 105 | 16 | 8  | 23  | 38  | 105 | 402 |     |     | 0  | 0       | 5       | -5      | -5      | -<br>10 |         |     |
| 03102318 | 21 | 20.0N | 133.2E  | 100 | 5  | 33 | 17  | 26  | 99  |     |     |     | 0  | 5       | -5      | -<br>10 | -5      |         |         |     |
| 03102400 | 22 | 20.4N | 133.5E  | 100 | 8  | 50 | 58  | 92  | 187 |     |     |     | 0  | 5       | -5      | -5      | -5      |         |         |     |
| 03102406 | 23 | 21.0N | 133.7E  | 90  | 0  | 34 | 37  | 72  | 108 |     |     |     | 0  | -5      | -5      | -5      | -<br>20 |         |         |     |
| 03102412 | 24 | 21.9N | 134.0E  | 85  | 5  | 25 | 34  | 56  | 91  |     |     |     | 0  | -<br>10 | -<br>10 | -<br>15 | -<br>25 |         |         |     |
| 03102418 | 25 | 23.0N | 134.8E  | 85  | 16 | 8  | 44  | 73  |     |     |     |     | 0  | -<br>15 | -<br>15 | -<br>25 |         |         |         |     |
| 03102500 | 26 | 24.5N | 135.7E  | 85  | 5  | 38 | 95  | 155 |     |     |     |     | 0  | -<br>10 | -<br>15 | -<br>20 |         |         |         |     |
| 03102506 | 27 | 25.9N | 137.1E  | 80  | 5  | 53 | 79  |     |     |     |     |     | 0  | -5      | -<br>15 |         |         |         |         |     |
| 03102512 | 28 | 27.8N | 139.1E  | 75  | 12 | 59 | 106 |     |     |     |     |     | 0  | -<br>10 | -<br>15 |         |         |         |         |     |
| 03102518 | 29 | 29.8N | 141.7E  | 70  | 35 | 50 |     |     |     |     |     |     | 0  | -<br>10 |         |         |         |         |         |     |
| 03102600 | 30 | 31.9N | 144.2E  | 70  | 0  | 42 |     |     |     |     |     |     | 0  | -<br>10 |         |         |         |         |         |     |
| 03102606 |    | 34.1N | 147.0E  | 70  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102612 |    | 36.1N | 150.3E  | 65  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |    |       | AVERAGE |     | 10 | 27 | 39  | 54  | 79  | 171 | 226 | 172 | 0  | 8       | 13      | 17      | 22      | 23      | 13      | 11  |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | 0  | -4      | -6      | -<br>11 | -<br>14 | -<br>17 | -<br>13 | -11 |
|          |    |       | # CASES |     | 30 | 30 | 28  | 26  | 24  | 20  | 15  | 11  | 30 | 30      | 28      | 26      | 24      | 20      | 15      | 11  |

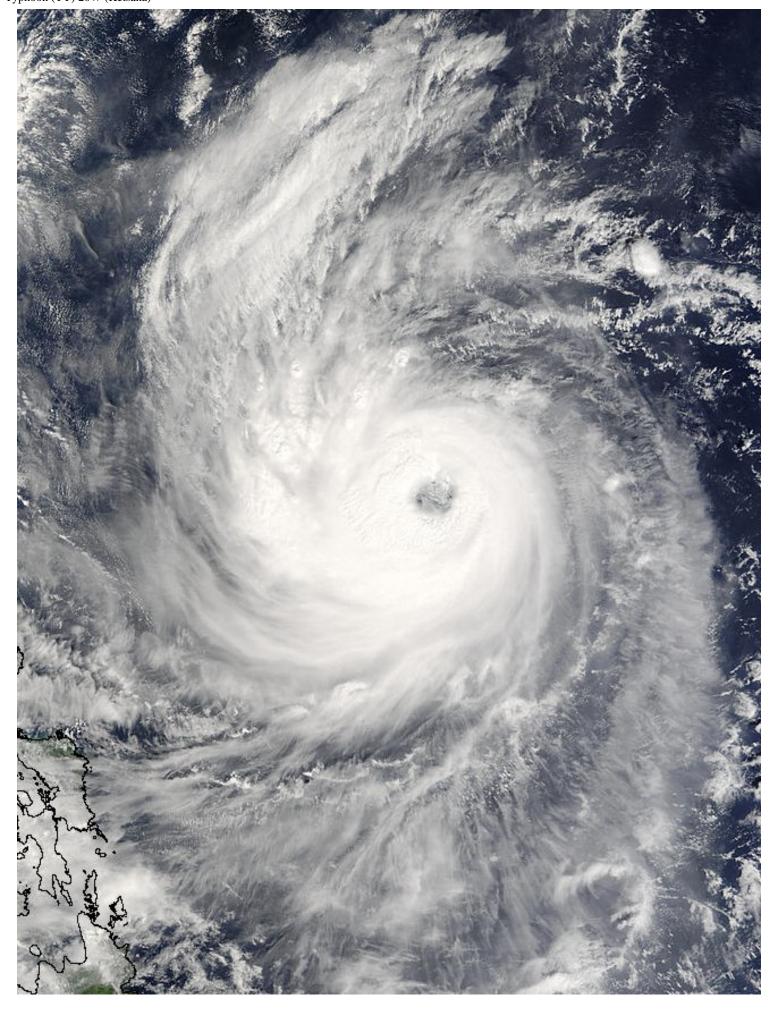


Figure 1-20W-1. 210155Z October 2003 MODIS true color image of 20W (Ketsana), northeast of the Philippines, with a peak intensity of 125 knots.

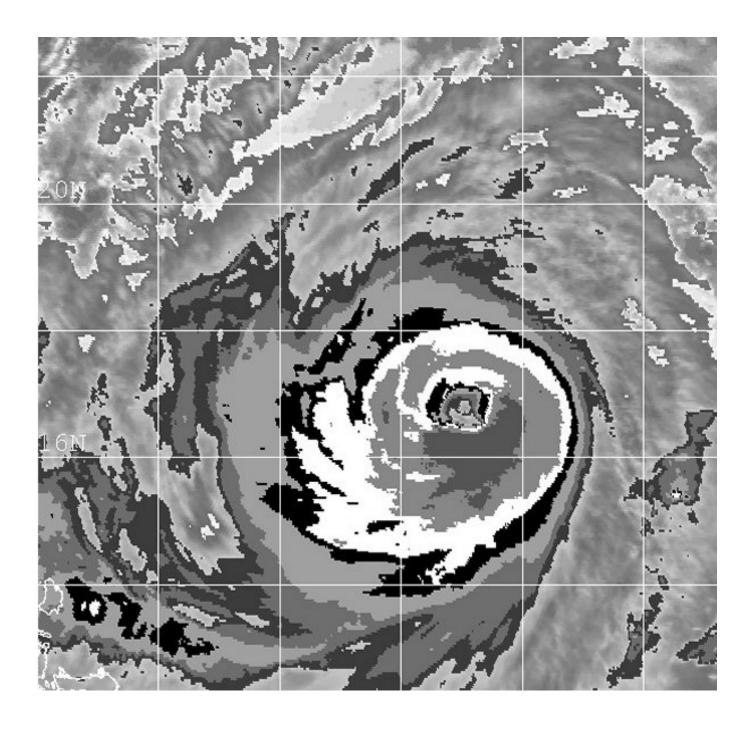


Figure 1-20W-2. 211246Z October 2003 Goes-9 enhanced infrared satellite imagery of TY 20W (Ketsana), located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

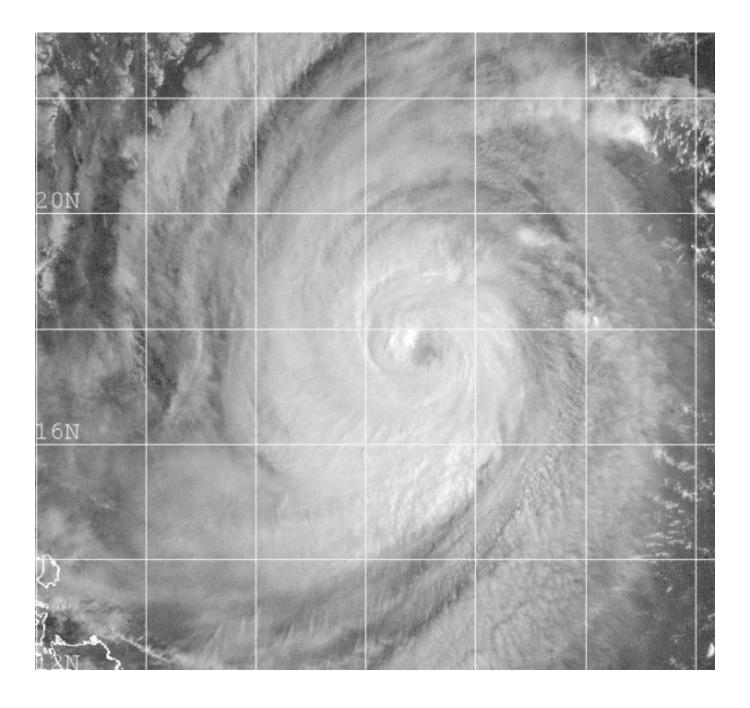
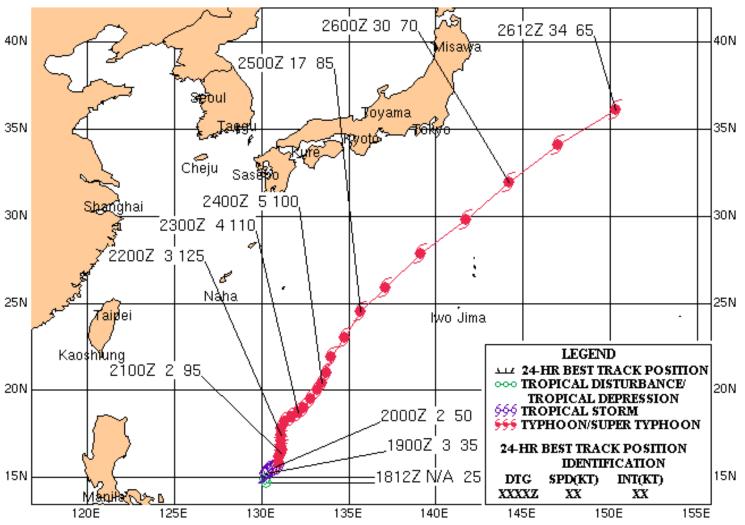
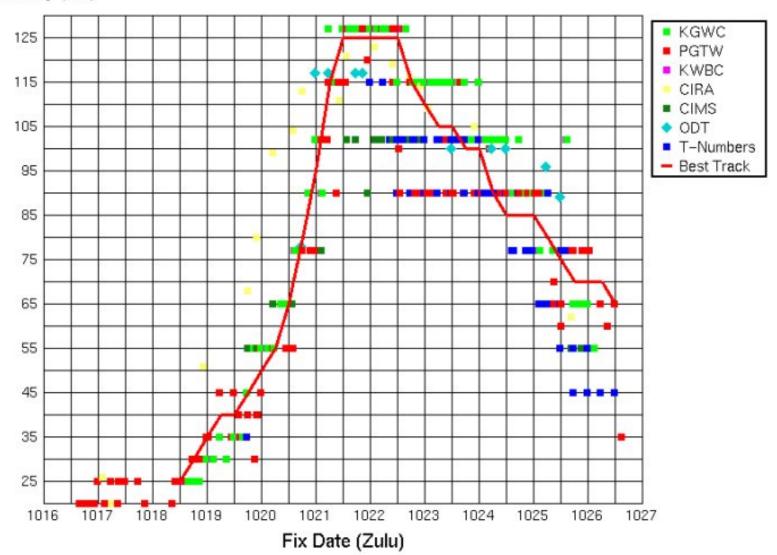


Figure 1-20W-3. 220120Z October 2003 Goes-9 visible satellite imagery of TY 20W (Ketsana), the eye was located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

### TYPHOON 20W (KETSANA) 18 - 26 OCTOBER 2003



## Time Intensity for 20W



## Typhoon (TY) 20W (Ketsana)\*



First Poor : 0600Z 15 Oct 03

First Fair: 0930Z 18 Oct 03

First TCFA: 1300Z 18 Oct 03

First Warning: 1800Z 18 Oct 03

Last Warning: 0000Z 26 Oct 03, Extratropical

Max Intensity: 125kts

Landfall: None

Total Warnings: 30

#### Remarks:

1) Typhoon (TY) 20W was first detected as a tropical disturbance approximately 700 NM east of Luzon Island around 0600Z on 15 October and was monitored for approximately 84 hours before first warning was issued. Of note was the near simultaneous development of TY 21W in the Northern Marianas Islands during the development of TY 20W. First warning for TY 21W was issued some 18 hours after the initial warning on TY 20W.

Development for TY 20W was noted as being initially slow, with abrupt consolidation less than 10 hours after being determined a fair suspect area with subsequent issuance of the first warning. Movement of this cyclone was initially very slow as it was located south of a weakness in the subtropical ridge.

The cyclone reached typhoon strength around 1200Z on 20 October due to dual channel upper level poleward and equatorward outflow. The continued weak steering flow caused TY 20W to move slowly poleward as it rapidly intensified over the next 24 hours to maximum intensity of 125 knots by 1200Z on 21 October. This rapid intensification phase (3.0 Dvorak T-numbers in 36 hours) ended after this time and the cyclone began shifting to a more northeastward track temporarily while slightly weakening.

By 1200Z on 23 October, TY 20W began to move more northeastward, pass the ridge axis increase track speed to 17 knots due to interaction with the mid-latitude westerlies. Vertical wind shear also increased and extratropical transition commenced. A pronounced dry slot was noted in microwave imagery by 1800Z on 24 October, with an extratropical final warning was issued at 0000Z on 26 October.

2) No damage reports were received for this cyclone.

\*Named by WMO Designated RSMC

|                      |     |                |                  | 04 4:      | 4.      |     |          | TVA      |          | T)/0       | 2014 | _   |    |         |          |          |         |         |              |     |
|----------------------|-----|----------------|------------------|------------|---------|-----|----------|----------|----------|------------|------|-----|----|---------|----------|----------|---------|---------|--------------|-----|
|                      |     |                |                  | Stati      | Stic    | S T | or J     | IWC      | on       | 1 Y 2      | :UVV |     |    |         |          |          |         |         |              |     |
|                      |     |                |                  |            |         |     |          |          |          |            |      |     |    |         |          |          |         |         |              |     |
| DTO                  |     | BEST           |                  |            |         |     |          | ERR      |          |            | 00   | 400 |    |         | ERF      |          |         |         | 0.0          | 100 |
| DTG<br>03101812      | NO. | 14.7N          | LONG<br>130.3E   | wind<br>25 | 00      | 12  | 24       | 36       | 48       | 72         | 96   | 120 | 00 | 12      | 24       | 36       | 48      | 72      | 96           | 120 |
| 03101818             | 1   | 14.9N          | 130.2E           | 30         | 13      | 42  | 76       | 114      | 133      | 158        |      |     | 0  | -5      | -5       | -<br>10  | -<br>30 | -<br>65 |              |     |
| 03101900             | 2   | 15.2N          | 130.2E           | 35         | 25      | 6   | 26       | 42       | 45       | 80         | 87   | 73  | 0  | 0       | 0        | -5       | -<br>25 | -<br>50 | -<br>30      | -10 |
| 03101906             | 3   | 15.3N          | 130.3E           | 40         | 11      | 29  | 41       | 17       | 21       | 122        | 177  | 262 | 0  | 5       | 0        | -<br>15  | -<br>45 | -<br>45 | -<br>15      | 0   |
| 03101912             | 4   | 15.4N          | 130.4E           | 40         | 11      | 21  | 26       | 6        | 49       | 130        | 184  | 301 | 0  | -5      | -<br>15  | -<br>35  | -<br>60 | -<br>55 | -<br>25      | -5  |
| 03101918             | 5   | 15.5N          | 130.6E           | 45         | 18      | 40  | 36       | 48       | 79       | 110        | 210  | 305 | 0  | -5      | -<br>20  | -<br>50  | -<br>55 | -<br>40 | -<br>20      | -5  |
| 03102000             | 6   | 15.6N          | 130.8E           | 50         | 17      | 25  | 33       | 71       | 111      | 201        | 281  | 259 | 0  | 10      | 30       | -<br>50  | -<br>40 | -<br>20 | -<br>20      | -15 |
| 03102006             | 7   | 15.7N          | 131.0E           | 55         | 11      | 12  | 12       | 26       | 55       | 56         | 111  | 49  | 0  | -<br>20 | -<br>45  | -<br>50  | -<br>40 | -<br>15 | -5           | -10 |
| 03102012             | 8   | 15.9N          | 131.0E           | 65         | 5       | 12  | 29       | 52       | 69       | 41         | 98   | 17  | 0  | -<br>25 | -<br>45  | -<br>35  | 30      | -<br>15 | -5           | -10 |
| 03102018             | 9   | 16.2N          | 131.0E           | 80         | 0       | 0   | 24       | 60       | 90       | 127        | 267  | 129 | 0  | -<br>20 | -<br>15  | -<br>10  | 5       | 5       | -5           | -10 |
| 03102100             | 10  | 16.4N          | 131.1E           | 95         | 6       | 21  |          | 82       |          |            | 307  |     |    | -<br>15 | -5       | 0        | 15      | 5       | -5           | -15 |
| 03102106             | 11  | 16.6N          | 131.2E           | 115        | 0       |     | 36       | 46       | 78       |            | 228  |     |    | 5       | 15       | 25       | 30      | 25      | 0            | -20 |
| 03102112<br>03102118 | 12  | 16.8N<br>17.1N | 131.1E<br>131.1E | 125<br>125 | 18<br>8 | 27  | 33<br>19 | 40<br>56 | 64<br>70 | 159<br>121 | 233  | 150 | 0  | 10<br>5 | 15<br>20 | 25<br>20 |         | 20<br>5 | -5<br>-5     | -20 |
| 03102110             | 14  |                | 131.1E           |            |         | 11  |          |          | 54       |            | 140  |     |    | 5       | 10       |          | -5      | -       | -<br>-<br>15 |     |
| 03102206             | 15  | 17.8N          | 131.1E           | 125        | 8       | 24  | 23       | 23       | 19       | 94         | 440  |     | 0  | 15      | 20       | 10       | 5       | -5      | -<br>15      |     |
| 03102212             | 16  | 18.2N          | 131.3E           | 125        | 8       | 25  | 27       | 32       | 30       | 173        | 498  |     | 0  | 5       | 0        | -5       | -5      | -<br>20 | -<br>30      |     |
| 03102218             | 17  | 18.5N          | 131.7E           | 115        | 6       | 31  | 30       | 34       | 24       | 222        |      |     | 0  | 0       | 0        | -<br>10  | -<br>10 | -<br>15 |              |     |
| 03102300             | 18  | 18.7N          | 132.1E           | 110        | 18      | 31  | 43       | 67       | 86       | 309        |      |     | 0  | 0       | 0        | -5       | -<br>15 | -<br>15 |              |     |
| 03102306             | 19  | 19.0N          | 132.4E           | 105        | 5       | 19  | 26       | 55       | 98       | 407        |      |     | 0  | 5       | 5        | 0        | -5      | -<br>10 |              |     |

| 03102312 | 20 | 19.5N | 132.8E  | 105 | 16 | 8  | 23  | 38  | 105 | 402 |     |     | 0  | 0       | 5       | -5      | -5      | -<br>10 |         |     |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03102318 | 21 | 20.0N | 133.2E  | 100 | 5  | 33 | 17  | 26  | 99  |     |     |     | 0  | 5       | -5      | -<br>10 | -5      |         |         |     |
| 03102400 | 22 | 20.4N | 133.5E  | 100 | 8  | 50 | 58  | 92  | 187 |     |     |     | 0  | 5       | -5      | -5      | -5      |         |         |     |
| 03102406 | 23 | 21.0N | 133.7E  | 90  | 0  | 34 | 37  | 72  | 108 |     |     |     | 0  | -5      | -5      | -5      | -<br>20 |         |         |     |
| 03102412 | 24 | 21.9N | 134.0E  | 85  | 5  | 25 | 34  | 56  | 91  |     |     |     | 0  | -<br>10 | -<br>10 | -<br>15 | -<br>25 |         |         |     |
| 03102418 | 25 | 23.0N | 134.8E  | 85  | 16 | 8  | 44  | 73  |     |     |     |     | 0  | -<br>15 | -<br>15 | -<br>25 |         |         |         |     |
| 03102500 | 26 | 24.5N | 135.7E  | 85  | 5  | 38 | 95  | 155 |     |     |     |     | 0  | -<br>10 | -<br>15 | -<br>20 |         |         |         |     |
| 03102506 | 27 | 25.9N | 137.1E  | 80  | 5  | 53 | 79  |     |     |     |     |     | 0  | -5      | -<br>15 |         |         |         |         |     |
| 03102512 | 28 | 27.8N | 139.1E  | 75  | 12 | 59 | 106 |     |     |     |     |     | 0  | -<br>10 | -<br>15 |         |         |         |         |     |
| 03102518 | 29 | 29.8N | 141.7E  | 70  | 35 | 50 |     |     |     |     |     |     | 0  | -<br>10 |         |         |         |         |         |     |
| 03102600 | 30 | 31.9N | 144.2E  | 70  | 0  | 42 |     |     |     |     |     |     | 0  | -<br>10 |         |         |         |         |         |     |
| 03102606 |    | 34.1N | 147.0E  | 70  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102612 |    | 36.1N | 150.3E  | 65  |    |    |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
|          |    |       | AVERAGE |     | 10 | 27 | 39  | 54  | 79  | 171 | 226 | 172 | 0  | 8       | 13      | 17      | 22      | 23      | 13      | 11  |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | 0  | -4      | -6      | -<br>11 | -<br>14 | -<br>17 | -<br>13 | -11 |
|          |    |       | # CASES |     | 30 | 30 | 28  | 26  | 24  | 20  | 15  | 11  | 30 | 30      | 28      | 26      | 24      | 20      | 15      | 11  |

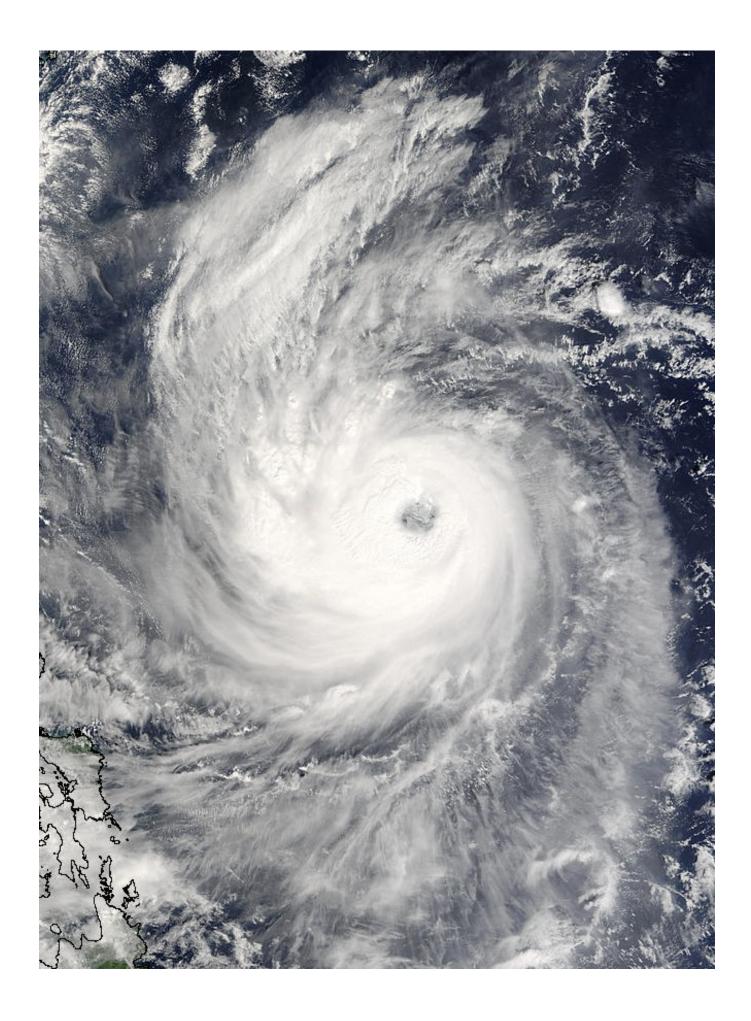


Figure 1-20W-1. 210155Z October 2003 MODIS true color image of 20W (Ketsana), northeast of the Philippines, with a peak intensity of 125 knots.

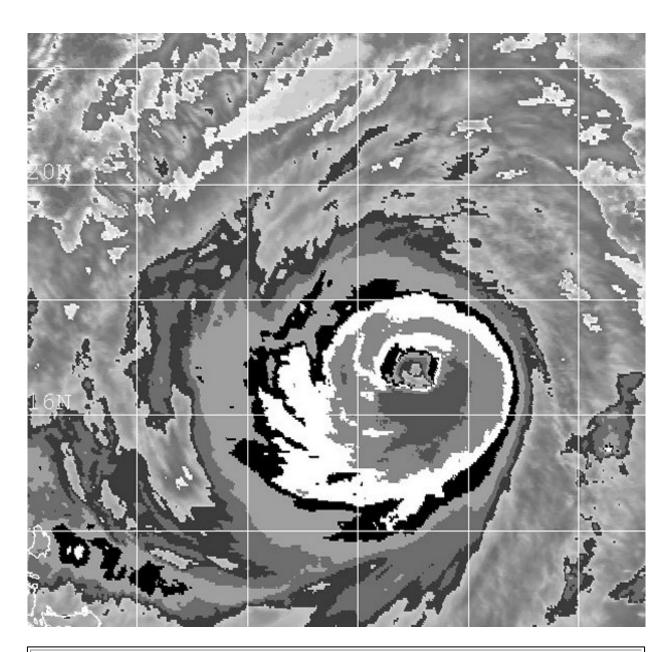


Figure 1-20W-2. 211246Z October 2003 Goes-9 enhanced infrared satellite imagery of TY 20W (Ketsana), located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

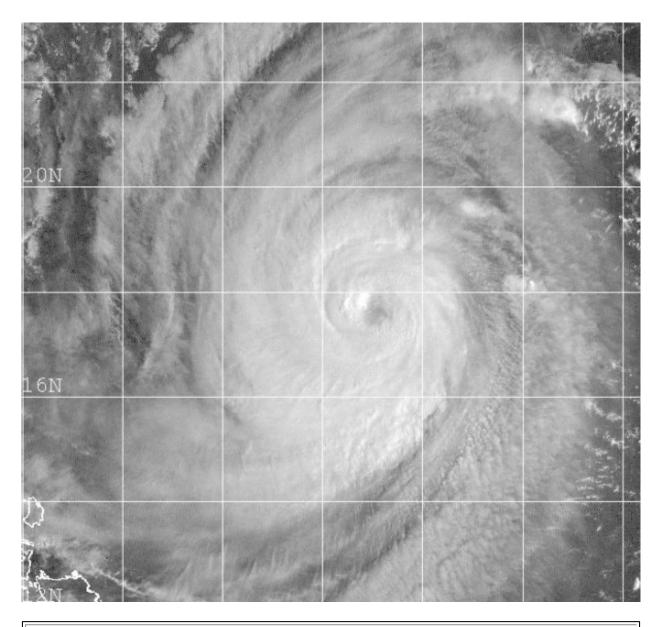
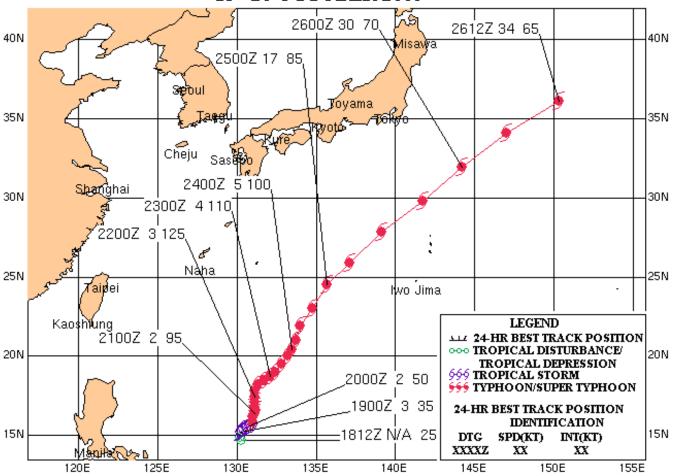
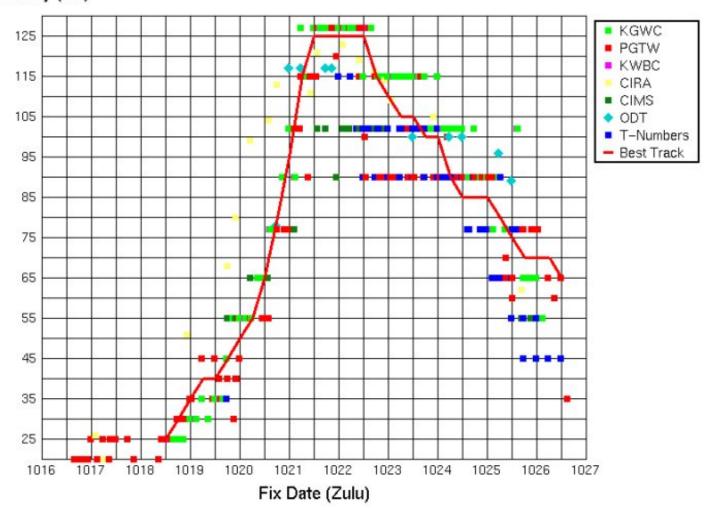


Figure 1-20W-3. 220120Z October 2003 Goes-9 visible satellite imagery of TY 20W (Ketsana), the eye was located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

### TYPHOON 20W (KETSANA) 18 - 26 OCTOBER 2003



# Time Intensity for 20W



## Typhoon (TY) 21W (Parma)\*



First Poor: 0300Z 18 Oct 03

First Fair: 0730Z 18 Oct 03

First TCFA: 1100Z 19 Oct 03

First Warning: 1200Z 20 Oct 03

Last Warning: 0600Z 31 Oct 03

Max Intensity: 130 kts, gusts to 160 kts

Landfall: N/A

Total Warnings: 44

#### Remarks:

1) Super Typhoon (STY) 21W developed in the monsoon trough around 18 October, approximately 220 nautical miles north-northeast of Guam. Subsequently, the circulation became more organized and tracked slowly north-northwestward along the south-western periphery of the subtropical ridge. As the cyclone approached the ridge axis, it rapidly intensified with radial outflow evident in metsat data.

At 0000Z on 23 October, a well defined poleward outflow channel developed due to a passing shortwave trough causing a second rapid intensification phase as the cyclone tracked quickly along the northwestern periphery of the building steering ridge. Intensification slowed 18 hours later as the poleward outflow channel diminshed briefly, but after a short weakening trend, the cyclone re-intensified in a weak vertical wind shear environment and attained a maximum intensity of 130 knots as it tracked eastward along the northern periphery of the subtropical ridge.

STY 21W began tracking equatorward along the eastern periphery of the steering anticyclone and weakened to 80 knots in an environment of marginal vertical wind shear and confluence aloft. As STY 21W rounded the southeastern quadrant of the steering anticyclone moving westward, it continued to weaken, reaching a minimum intensity of 65 knots approximately 185 nautical miles north of Wake Island.

As STY 21W tracked rapidly along the equatorward side of the steering anti-cyclone, it re-intensified after 18 hours in an environment of weak vertical wind shear. A mid-latitude trough exiting Asia allowed the cyclone to turn poleward. As the cyclone again crested the western periphery of the subtropical ridge, it reached a second peak in intensity of 115 knots around 1200Z on 29 October. Following this last intensification period, the cyclone began weakening rapidly as it entered an environment of moderate vertical wind shear.

By 0000Z on 30 October, STY 21W began the initial stages of extratropical transition as it interacted with the baroclinic zone and the mid-latitude westerlies while weakening and tracking rapidly northeastward. Within 24 hours, the rapidly weakening cyclone had decoupled from the upper level convection and completed transition into an extratropical low approximately 820 nautical miles north of Wake Island.

2) No reports of damage were received for this cyclone.

|          |     |        |        | Stati | stic | s fo | r JT | WC  | on 7 | ΓΥ21\ | W   |     |    |         |         |         |         |         |         |     |
|----------|-----|--------|--------|-------|------|------|------|-----|------|-------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |        |        |       |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST T | TRACK  |       | PC   | SITI | ON E | RRC | RS   |       |     |     | WI | ND      | ER      | RO      | RS      |         |         |     |
| DTG      | NO. | LAT    | LONG   | wind  | 00   | 12   | 24   | 36  | 48   | 72    | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03101806 |     | 16.8N  | 146.7E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101812 |     | 17.2N  | 146.4E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101818 |     | 17.6N  | 146.1E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101900 |     | 18.0N  | 145.8E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101906 |     | 18.5N  | 145.3E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101912 |     | 19.0N  | 144.6E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101918 |     | 19.4N  | 143.9E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102000 |     | 19.7N  | 143.5E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102006 |     | 20.1N  | 143.1E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102012 | 1   | 20.5N  | 142.8E | 25    | 8    | 68   | 106  | 123 | 134  | 56    |     |     | 0  | -5      | -<br>10 | -<br>10 | -<br>20 | -<br>55 |         |     |
| 03102018 | 2   | 21.0N  | 143.2E | 30    | 51   | 140  | 169  | 151 | 147  | 70    |     |     | 0  | 15      | 15      | 5       | -<br>10 | -<br>55 |         |     |
| 03102100 | 3   | 21.3N  | 143.8E | 35    | 62   | 124  | 133  | 113 | 97   | 65    | 183 |     | 0  | 0       | 5       | 0       | -<br>20 | -<br>70 | -<br>90 |     |
| 03102106 | 4   | 21.7N  | 144.5E | 35    | 12   | 41   | 58   | 71  | 51   | 34    | 128 |     | 0  | -5      | -<br>10 | -<br>10 | -<br>30 | -<br>80 | -<br>85 |     |
| 03102112 | 5   | 22.0N  | 145.2E | 45    | 16   | 31   | 32   | 8   | 34   | 138   | 156 |     | 0  | 5       | -5      | -5      | -<br>40 | -<br>80 | -<br>80 |     |
| 03102118 | 6   | 22.3N  | 145.8E | 45    | 12   | 33   | 28   | 37  | 73   | 279   | 350 |     | 0  | 0       | 5       | -<br>25 | -<br>50 | -<br>85 | -<br>75 |     |
| 03102200 | 7   | 22.6N  | 146.4E | 50    | 5    | 13   | 42   | 91  | 141  | 259   |     |     | 0  | -5      | -<br>10 | -<br>55 | -<br>70 | -<br>90 |         |     |
| 03102206 | 8   | 23.2N  | 146.8E | 60    | 18   | 38   | 90   | 133 | 190  | 303   | 479 |     | 0  | 5       | -<br>10 | -<br>20 | -<br>55 | -<br>65 | -<br>55 |     |
| 03102212 | 9   | 23.7N  | 147.4E | 65    | 13   | 52   | 72   | 119 | 155  | 248   |     |     | 0  | 10      | -<br>30 | -<br>50 | -<br>75 | -<br>80 |         |     |
| 03102218 | 10  | 24.3N  | 148.1E | 65    | 13   | 42   | 77   | 126 | 195  | 321   |     |     | 0  | -<br>15 | -<br>35 | -<br>65 | -<br>75 | -<br>65 |         |     |
| 03102300 | 11  | 25.2N  | 149.0E | 75    | 36   | 62   | 88   | 141 | 180  | 360   |     |     | 0  | -<br>20 | -<br>35 | -<br>60 | -<br>70 | -<br>50 |         |     |
| 03102306 | 12  | 26.2N  | 149.8E | 90    | 0    | 24   | 80   | 175 | 232  | 451   |     |     | 0  | -5      | -<br>30 | -<br>45 | -<br>50 | -<br>45 |         |     |

| 03102312 | 13 | 27.1N | 150.9E | 110 | 0  | 32  | 81  | 111 | 222 | 773  |     |     | 0       | -5            | -<br>45 | -<br>65 | -<br>70 | -<br>35 |         |   |
|----------|----|-------|--------|-----|----|-----|-----|-----|-----|------|-----|-----|---------|---------------|---------|---------|---------|---------|---------|---|
| 03102318 | 14 | 28.2N | 152.3E | 105 | 0  | 33  | 109 | 232 | 414 |      |     |     | 0       | -<br>25       | -<br>45 | -<br>60 | -<br>60 |         |         |   |
| 03102400 | 15 | 29.2N | 154.2E | 115 | 13 | 45  | 131 | 314 | 545 |      |     |     | 0       | -<br>25       | -<br>40 | -<br>50 | -<br>50 |         |         |   |
| 03102406 | 16 | 30.1N | 156.3E | 125 | 0  | 69  | 217 | 429 | 570 |      |     |     | 0       | -<br>15       | -<br>30 | -<br>35 | -<br>40 |         |         |   |
| 03102412 | 17 | 30.8N | 158.7E | 130 | 0  | 102 | 271 | 392 | 506 |      |     |     | -5      | -<br>15       | -<br>25 | -<br>30 | -<br>35 |         |         |   |
| 03102418 | 18 | 30.8N | 161.6E | 130 | 15 | 147 | 278 | 452 | 710 | 1206 |     |     | 0       | -<br>10       | -<br>15 | -<br>20 | -<br>15 | -<br>40 |         |   |
| 03102500 | 19 | 30.1N | 163.6E | 125 | 0  | 66  | 129 | 271 | 549 | 1093 |     |     | 0       | -<br>10       | -<br>10 | -<br>15 | -<br>15 | -<br>40 |         |   |
| 03102506 | 20 | 28.8N | 165.5E | 120 | 0  | 48  | 87  | 261 | 463 | 897  |     |     | 0       | 5             | 0       | 5       | -<br>10 | -<br>40 |         |   |
| 03102512 | 21 | 27.6N | 167.1E | 115 | 17 | 42  | 170 | 381 | 549 | 796  |     |     | 0       | 5             | 0       | 0       | -<br>25 | -<br>45 |         |   |
| 03102518 | 22 | 26.4N | 168.5E | 105 | 0  | 73  | 257 | 426 | 585 | 807  |     |     | 0       | 0             | 10      | -5      | -<br>30 | -<br>65 |         |   |
| 03102600 | 23 | 25.1N | 169.3E | 95  | 0  | 85  | 299 | 473 | 624 | 804  |     |     | 0       | 0             | 0       | -<br>25 | -<br>35 | -<br>70 |         |   |
| 03102606 | 24 | 24.0N | 169.4E | 90  | 16 | 78  | 119 | 135 | 147 | 240  | 286 | 765 | 0       | 20            | 10      | -5      | -<br>10 | -<br>50 | -<br>40 | 5 |
| 03102612 | 25 | 23.0N | 168.8E | 80  | 24 | 46  | 78  | 105 | 119 | 164  | 230 | 694 | 0       | 10            | -<br>10 | -<br>15 | -<br>25 | -<br>65 | -<br>40 | 5 |
| 03102618 | 26 | 22.4N | 167.3E | 65  | 11 | 51  | 51  | 84  | 121 | 141  | 255 |     | 0       | -5            | -<br>20 | -<br>20 | -<br>35 | -<br>50 | -<br>15 |   |
| 03102700 | 27 | 22.2N | 165.8E | 65  | 0  | 13  | 73  | 106 | 156 | 94   | 262 |     | 0       | -<br>15       | -<br>15 | -<br>15 | -<br>25 | -<br>45 | -<br>10 |   |
| 03102706 | 28 | 22.2N | 164.5E | 65  | 5  | 39  | 57  | 107 | 72  | 176  | 635 |     | 0       | -<br>10       | -<br>10 | -<br>25 | -<br>30 | -<br>20 | 20      |   |
| 03102712 | 29 | 22.0N | 162.6E | 75  | 17 | 51  | 68  | 130 | 87  | 151  | 570 |     | 0       | 0             | 0       | -<br>10 | -<br>15 | 0       | 35      |   |
| 03102718 | 30 | 22.0N | 160.4E | 75  | 6  | 29  | 66  | 67  | 50  | 175  |     |     | 0       | 5             | -<br>10 | -<br>20 | -<br>25 | 5       |         |   |
| 03102800 | 31 | 21.9N | 158.2E | 75  | 8  | 38  | 37  | 53  | 30  | 165  |     |     | 0       | -5            | -       | -<br>30 | -       | 40      |         |   |
| 03102806 | 32 | 21.9N | 156.2E | 75  | 8  | 30  | 53  | 52  | 16  | 233  |     |     | 0       | -<br>20       | -<br>30 | -<br>30 | -<br>20 | 20      |         |   |
| 03102812 | 33 | 22.0N | 154.2E | 80  | 0  | 23  | 22  | 26  | 46  | 339  |     |     | 0       | -             | -       | -<br>30 | -       | 25      |         |   |
| 03102818 | 34 | 22.6N | 152.1E | 95  | 0  | 13  | 17  | 57  | 132 |      |     |     | -<br>10 | -<br>20       | -<br>20 | -<br>10 | 0       |         |         |   |
| 03102900 | 35 | 23.1N | 150.6E | 95  | 12 | 16  | 42  | 116 | 171 |      |     |     |         | -<br>15       | _       |         | 10      |         |         |   |
| 03102906 | 36 | 23.8N | 149.4E | 110 | 8  | 25  | 76  | 157 | 258 |      |     |     | _       | -<br>15       | _       |         | 20      |         |         |   |
| 03102912 | 37 | 24.8N | 148.9E | 115 | 5  | 49  | 121 | 200 | 336 |      |     |     | -5      | $\overline{}$ |         | 15      | 25      |         |         |   |

| 03102918 | 38 | 25.7N | 149.2E  | 115 | 0  | 38 | 122 | 201 |     |     |     |     | 0  | 0  | 10      | 20      |         |         |         |   |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|----|----|---------|---------|---------|---------|---------|---|
| 03103012 | 39 | 28.9N | 153.9E  | 90  | 0  | 57 | 209 |     |     |     |     |     | 0  | 5  | 15      |         |         |         |         |   |
| 03103018 | 40 | 29.7N | 156.7E  | 80  | 0  | 43 |     |     |     |     |     |     | 5  | 15 |         |         |         |         |         |   |
| 03103100 | 41 | 30.5N | 159.5E  | 70  | 0  | 59 |     |     |     |     |     |     | 0  | 10 |         |         |         |         |         |   |
| 03103106 | 42 | 31.4N | 163.1E  | 55  | 0  |    |     |     |     |     |     |     | 0  |    |         |         |         |         |         |   |
| 03103112 |    | 32.3N | 167.0E  | 45  |    |    |     |     |     |     |     |     |    |    |         |         |         |         |         |   |
|          |    |       | AVERAGE |     | 10 | 51 | 108 | 174 | 246 | 374 | 321 | 729 | 1  | 10 | 17      | 24      | 33      | 50      | 50      | 5 |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | -1 | -4 | -<br>13 | -<br>21 | -<br>30 | -<br>46 | -<br>40 | 5 |
|          |    |       | # CASES |     | 42 | 41 | 39  | 38  | 37  | 29  | 11  | 2   | 42 | 41 | 39      | 38      | 37      | 29      | 11      | 2 |

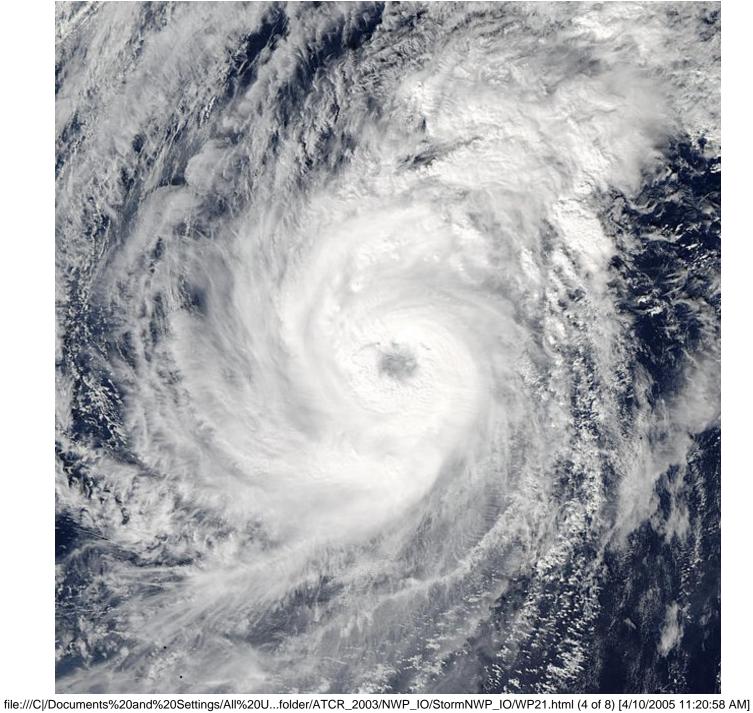




Figure 1-21W-1. 230310Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an increasing intensity of 90 knots.

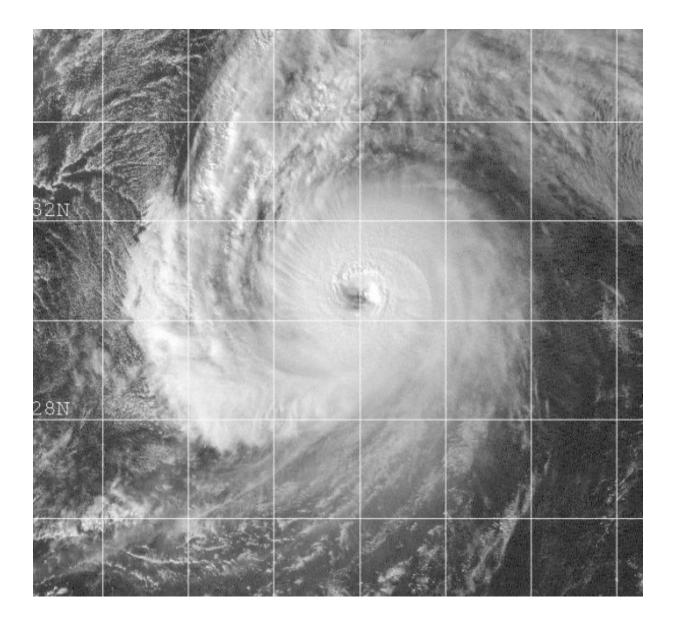


Figure 1-21W-2. 240449Z October 2003 Goes-9 visible satellite imagery of TY 21W (Parma), the eye was located 840 nm northeast of Iwo Jima at its peak intensity of 125 knots.

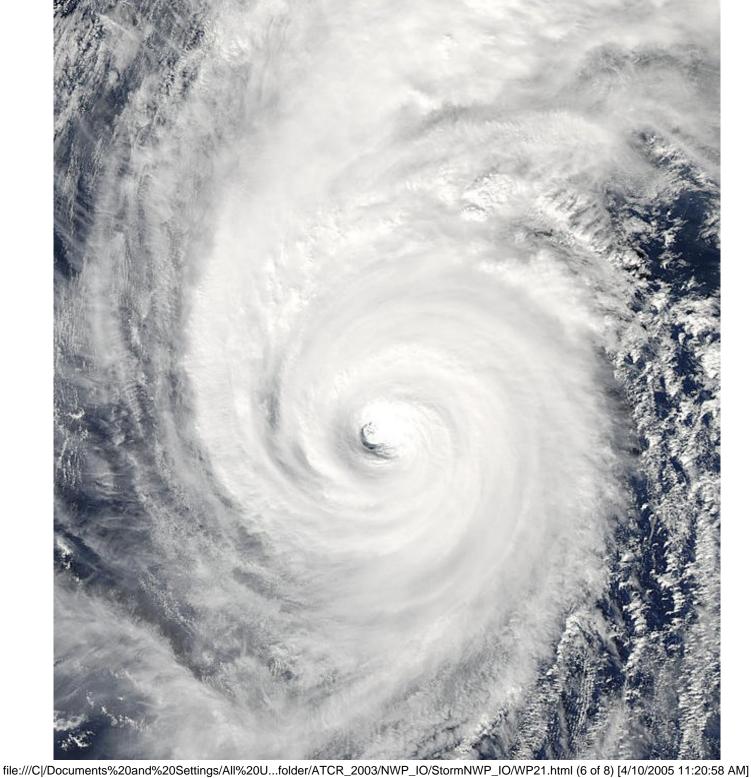
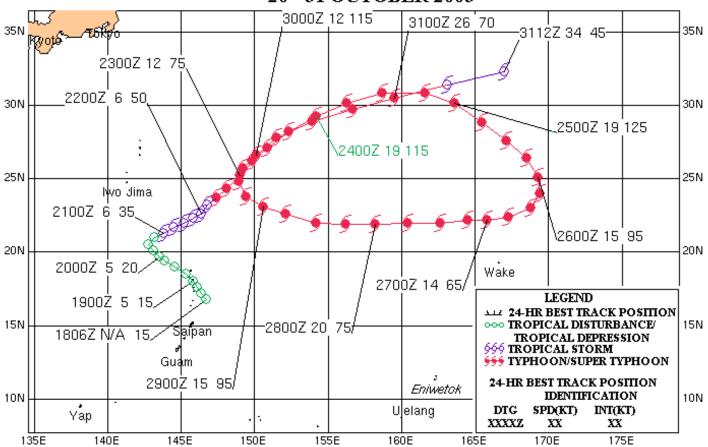


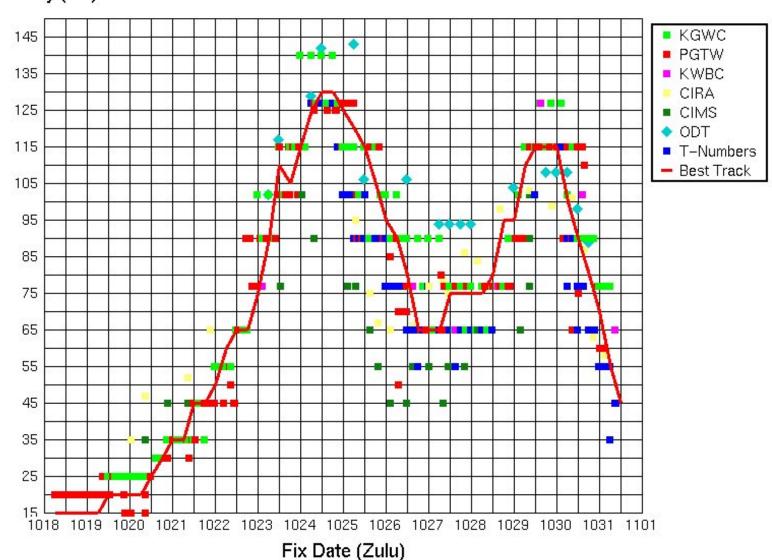


Figure 1-21W-3. 300315Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an intensity of 100 knots.

### TYPHOON 21W (PARMA) 20 - 31 OCTOBER 2003



# Time Intensity for 21W



### Typhoon (TY) 21W (Parma)\*



First Poor: 0300Z 18 Oct 03

First Fair: 0730Z 18 Oct 03

First TCFA: 1100Z 19 Oct 03

First Warning: 1200Z 20 Oct 03

Last Warning: 0600Z 31 Oct 03

Max Intensity: 130 kts, gusts to 160 kts

Landfall: N/A

Total Warnings: 44

#### Remarks:

1) Super Typhoon (STY) 21W developed in the monsoon trough around 18 October, approximately 220 nautical miles north-northeast of Guam. Subsequently, the circulation became more organized and tracked slowly north-northwestward along the south-western periphery of the subtropical ridge. As the cyclone approached the ridge axis, it rapidly intensified with radial outflow evident in metsat data.

At 0000Z on 23 October, a well defined poleward outflow channel developed due to a passing shortwave trough causing a second rapid intensification phase as the cyclone tracked quickly along the northwestern periphery of the building steering ridge. Intensification slowed 18 hours later as the poleward outflow channel diminshed briefly, but after a short weakening trend, the cyclone re-intensified in a weak vertical wind shear environment and attained a maximum intensity of 130 knots as it tracked eastward along the northern periphery of the subtropical ridge.

STY 21W began tracking equatorward along the eastern periphery of the steering anticyclone and weakened to 80 knots in an environment of marginal vertical wind shear and confluence aloft. As STY 21W rounded the southeastern quadrant of the steering anticyclone moving westward, it continued to weaken, reaching a minimum intensity of 65 knots approximately 185 nautical miles north of Wake Island.

As STY 21W tracked rapidly along the equatorward side of the steering anti-cyclone, it re-intensified after 18 hours in an environment of weak vertical wind shear. A mid-latitude trough exiting Asia allowed the cyclone to turn poleward. As the cyclone again crested the western periphery of the subtropical ridge, it reached a second peak in intensity of 115 knots around 1200Z on 29 October. Following this last intensification period, the cyclone began weakening rapidly as it entered an environment of moderate vertical wind shear.

By 0000Z on 30 October, STY 21W began the initial stages of extratropical transition as it interacted with the baroclinic zone and the mid-latitude westerlies while weakening and tracking rapidly northeastward. Within 24 hours, the rapidly weakening cyclone had decoupled from the upper level convection and completed transition into an extratropical low approximately 820 nautical miles north of Wake Island.

2) No reports of damage were received for this cyclone.

\*Named by WMO Designated RSMC

|          |     |       |        | Stati | stic | s fo | r JT | wc  | on 1 | ΓΥ21\ | W   |     |    |         |         |         |         |         |         |     |
|----------|-----|-------|--------|-------|------|------|------|-----|------|-------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          |     |       |        |       |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
|          | WRN | BEST  | TRACK  |       | PC   | SITI | ON E | RRC | RS   |       |     |     | WI | ND      | ER      | RO      | RS      |         |         |     |
| DTG      | NO. | LAT   | LONG   | wind  | 00   | 12   | 24   | 36  | 48   | 72    | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03101806 |     | 16.8N | 146.7E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101812 |     | 17.2N | 146.4E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101818 |     | 17.6N | 146.1E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101900 |     | 18.0N | 145.8E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101906 |     | 18.5N | 145.3E | 15    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101912 |     | 19.0N | 144.6E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03101918 |     | 19.4N | 143.9E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102000 |     | 19.7N | 143.5E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102006 |     | 20.1N | 143.1E | 20    |      |      |      |     |      |       |     |     |    |         |         |         |         |         |         |     |
| 03102012 | 1   | 20.5N | 142.8E | 25    | 8    | 68   | 106  | 123 | 134  | 56    |     |     | 0  | -5      | -<br>10 | -<br>10 | -<br>20 | -<br>55 |         |     |
| 03102018 | 2   | 21.0N | 143.2E | 30    | 51   | 140  | 169  | 151 | 147  | 70    |     |     | 0  | 15      | 15      | 5       | -<br>10 | -<br>55 |         |     |
| 03102100 | 3   | 21.3N | 143.8E | 35    | 62   | 124  | 133  | 113 | 97   | 65    | 183 |     | 0  | 0       | 5       | 0       | -<br>20 | -<br>70 | -<br>90 |     |
| 03102106 | 4   | 21.7N | 144.5E | 35    | 12   | 41   | 58   | 71  | 51   | 34    | 128 |     | 0  | -5      | -<br>10 | -<br>10 | -<br>30 | -<br>80 | -<br>85 |     |
| 03102112 | 5   | 22.0N | 145.2E | 45    | 16   | 31   | 32   | 8   | 34   | 138   | 156 |     | 0  | 5       | -5      | -5      | -<br>40 | -<br>80 | -<br>80 |     |
| 03102118 | 6   | 22.3N | 145.8E | 45    | 12   | 33   | 28   | 37  | 73   | 279   | 350 |     | 0  | 0       | 5       | -<br>25 | -<br>50 | -<br>85 | -<br>75 |     |
| 03102200 | 7   | 22.6N | 146.4E | 50    | 5    | 13   | 42   | 91  | 141  | 259   |     |     | 0  | -5      | -<br>10 | -<br>55 | -<br>70 | -<br>90 |         |     |
| 03102206 | 8   | 23.2N | 146.8E | 60    | 18   | 38   | 90   | 133 | 190  | 303   | 479 |     | 0  | 5       | -<br>10 | -<br>20 | -<br>55 | -<br>65 | -<br>55 |     |
| 03102212 | 9   | 23.7N | 147.4E | 65    | 13   | 52   | 72   | 119 | 155  | 248   |     |     | 0  | 10      | -<br>30 | -<br>50 | -<br>75 | -<br>80 |         |     |
| 03102218 | 10  | 24.3N | 148.1E | 65    | 13   | 42   | 77   | 126 | 195  | 321   |     |     | 0  | -       | -       | -       | -       | -<br>65 |         |     |
| 03102300 | 11  | 25.2N | 149.0E | 75    | 36   | 62   | 88   | 141 | 180  | 360   |     |     | 0  | -<br>20 | -<br>35 | -<br>60 | -<br>70 | -<br>50 |         |     |
| 03102306 | 12  | 26.2N | 149.8E | 90    | 0    | 24   | 80   | 175 | 232  | 451   |     |     | 0  | -5      | -<br>30 | -<br>45 | -<br>50 | -<br>45 |         |     |
| 03102312 | 13  | 27.1N | 150.9E | 110   | 0    | 32   | 81   | 111 | 222  | 773   |     |     | 0  | -5      | -<br>45 | -<br>65 | -<br>70 | -<br>35 |         |     |
| 03102318 | 14  | 28.2N | 152.3E | 105   | 0    | 33   | 109  | 232 | 414  |       |     |     | 0  | -<br>25 | -<br>45 | -<br>60 | -<br>60 |         |         |     |
| 03102400 | 15  | 29.2N | 154.2E | 115   | 13   | 45   | 131  | 314 | 545  |       |     |     | 0  | -<br>25 | -<br>40 | -<br>50 | -<br>50 |         |         |     |
| 03102406 | 16  | 30.1N | 156.3E | 125   | 0    | 69   | 217  | 429 | 570  |       |     |     | 0  | -<br>15 | -<br>30 | -<br>35 | -<br>40 |         |         |     |

| 03102412 | 17       | 30.8N  | 158.7E  | 130 | 0  | 102 | 271 | 392 | 506 |      |     |     | -5      | 15      | 25      | 30      | 35      |         |         |   |
|----------|----------|--------|---------|-----|----|-----|-----|-----|-----|------|-----|-----|---------|---------|---------|---------|---------|---------|---------|---|
| 03102418 | 18       | 30.8N  | 161.6E  | 130 | 15 | 147 | 278 | 452 | 710 | 1206 |     |     | 0       | -<br>10 | -<br>15 | -<br>20 | -<br>15 | -<br>40 |         |   |
| 03102500 | 19       | 30.1N  | 163.6E  | 125 | 0  | 66  | 129 | 271 | 549 | 1093 |     |     | 0       | -<br>10 | -<br>10 | -<br>15 | -<br>15 | -<br>40 |         |   |
| 03102506 | 20       | 28.8N  | 165.5E  | 120 | 0  | 48  | 87  | 261 | 463 | 897  |     |     | 0       | 5       | 0       | 5       | -<br>10 | -<br>40 |         |   |
| 03102512 | 21       | 27.6N  | 167.1E  | 115 | 17 | 42  | 170 | 381 | 549 | 796  |     |     | 0       | 5       | 0       | 0       | -<br>25 | -<br>45 |         |   |
| 03102518 | 22       | 26.4N  | 168.5E  | 105 | 0  | 73  | 257 | 426 | 585 | 807  |     |     | 0       | 0       | 10      | -5      | -<br>30 | -<br>65 |         |   |
| 03102600 | 23       | 25.1N  | 169.3E  | 95  | 0  | 85  | 299 | 473 | 624 | 804  |     |     | 0       | 0       | 0       | -<br>25 | -<br>35 | -<br>70 |         |   |
| 03102606 | 24       | 24.0N  | 169.4E  | 90  | 16 | 78  | 119 | 135 | 147 | 240  | 286 | 765 | 0       | 20      | 10      | -5      | -<br>10 | -<br>50 | -<br>40 | 5 |
| 03102612 | 25       | 23.0N  | 168.8E  | 80  | 24 | 46  | 78  | 105 | 119 | 164  | 230 | 694 | 0       | 10      | -<br>10 | -<br>15 | -<br>25 | -<br>65 | -<br>40 | 5 |
| 03102618 | 26       | 22.4N  | 167.3E  | 65  | 11 | 51  | 51  | 84  | 121 | 141  | 255 |     | 0       | -5      | -<br>20 | -<br>20 | -<br>35 | -<br>50 | -<br>15 |   |
| 03102700 | 27       | 22.2N  | 165.8E  | 65  | 0  | 13  | 73  | 106 | 156 | 94   | 262 |     | 0       | -<br>15 | -<br>15 | -<br>15 | -<br>25 | -<br>45 | -<br>10 |   |
| 03102706 | 28       | 22.2N  | 164.5E  | 65  | 5  | 39  | 57  | 107 | 72  | 176  | 635 |     | 0       | -<br>10 | -<br>10 | -<br>25 | -<br>30 | -<br>20 | 20      |   |
| 03102712 | 29       | 22.0N  | 162.6E  | 75  | 17 | 51  | 68  | 130 | 87  | 151  | 570 |     | 0       | 0       | 0       | -<br>10 | -<br>15 | 0       | 35      |   |
| 03102718 | 30       | 22.0N  | 160.4E  | 75  | 6  | 29  | 66  | 67  | 50  | 175  |     |     | 0       | 5       | -<br>10 | -<br>20 | -<br>25 | 5       |         |   |
| 03102800 | 31       | 21.9N  | 158.2E  | 75  | 8  | 38  | 37  | 53  | 30  | 165  |     |     | 0       | -5      | -<br>15 | -<br>30 | -<br>30 | 10      |         |   |
| 03102806 | 32       | 21.9N  | 156.2E  | 75  | 8  | 30  | 53  | 52  | 16  | 233  |     |     | 0       | -<br>20 | -<br>30 | -<br>30 | -<br>20 | 20      |         |   |
| 03102812 | 33       | 22.0N  | 154.2E  | 80  | 0  | 23  | 22  | 26  | 46  | 339  |     |     | 0       | -<br>15 | -<br>30 | -<br>30 | -<br>10 | 25      |         |   |
| 03102818 | 34       | 22.6N  | 152.1E  | 95  | 0  | 13  | 17  | 57  | 132 |      |     |     | -<br>10 | -<br>20 | -<br>20 | -<br>10 | 0       |         |         |   |
| 03102900 | 35       | 23.1N  | 150.6E  | 95  | 12 | 16  | 42  | 116 | 171 |      |     |     | 0       | -       | _       | 0       | 10      |         |         |   |
| 03102906 | 36       | 23.8N  | 149.4E  | 110 | 8  | 25  | 76  | 157 | 258 |      |     |     | -<br>15 | -<br>15 | -<br>10 | 0       | 20      |         |         |   |
| 03102912 | 37       | 24.8N  | 148.9E  | 115 | 5  | 49  | 121 | 200 | 336 |      |     |     | -5      | 0       | 10      | 15      | 25      |         |         |   |
| 03102918 | 38       | 25.7N  | 149.2E  | 115 | 0  | 38  | 122 | 201 |     |      |     |     | 0       | 0       | 10      | 20      |         |         |         |   |
| 03103012 | 39       | 28.9N  | 153.9E  | 90  | 0  | 57  | 209 |     |     |      |     |     | 0       | 5       | 15      |         |         |         |         |   |
| 03103018 | 40       | 29.7N  | 156.7E  | 80  | 0  | 43  |     |     |     | J    |     |     | 5       | 15      |         |         |         |         |         |   |
|          | 41       | 30.5N  | 159.5E  | 70  | 0  | 59  |     |     |     |      |     |     | 0       | 10      |         |         |         |         |         |   |
|          | 42       |        | 163.1E  | 55  | 0  |     |     |     |     |      |     |     | 0       |         |         |         |         |         |         |   |
| 03103112 | <u>-</u> |        | 167.0E  | 45  |    |     |     |     |     |      |     |     |         |         |         |         |         |         |         |   |
| 00100112 |          | 32.014 | AVERAGE |     | 10 | 51  | 108 | 174 | 246 | 374  | 321 | 729 | 1       | 10      | 17      | 24      | 33      | 50      | 50      | 5 |
|          |          |        | BIAS    |     |    |     |     |     |     |      |     |     | -1      |         | -       | -<br>21 | -       | -       | -       | 5 |
|          |          |        | # CASES |     | 42 | 41  | 39  | 38  | 37  | 29   | 11  | 2   | 42      | 41      |         | 38      |         |         |         | 2 |
|          |          |        | # CASES |     | 42 | 71  | 09  | 30  | 31  | 23   | 11  | _   | 42      | 41      | ၂၁၁     | 30      | 31      | 23      | 11      | _ |

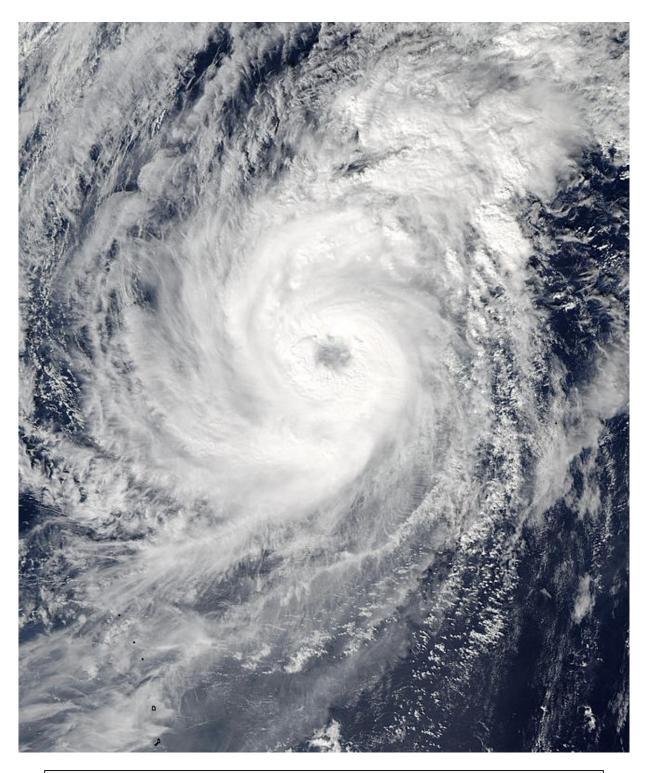


Figure 1-21W-1. 230310Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an increasing intensity of 90 knots.

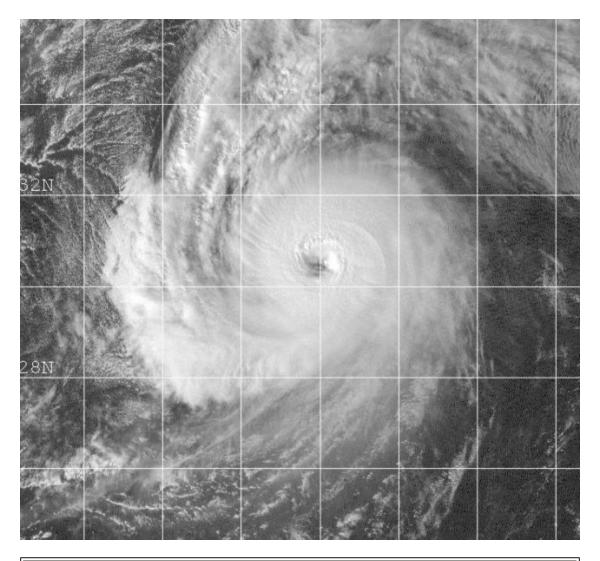
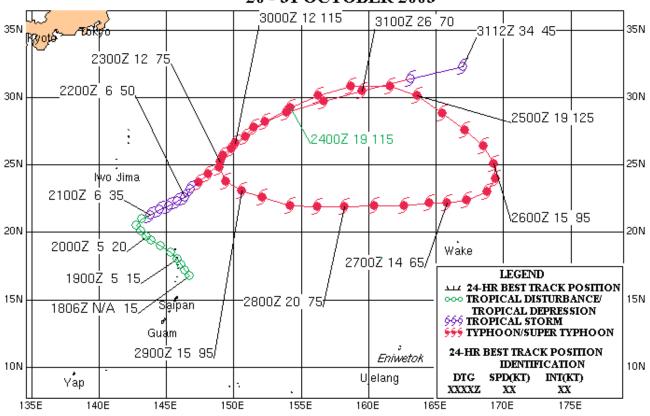


Figure 1-21W-2. 240449Z October 2003 Goes-9 visible satellite imagery of TY 21W (Parma), the eye was located 840 nm northeast of Iwo Jima at its peak intensity of 125 knots.

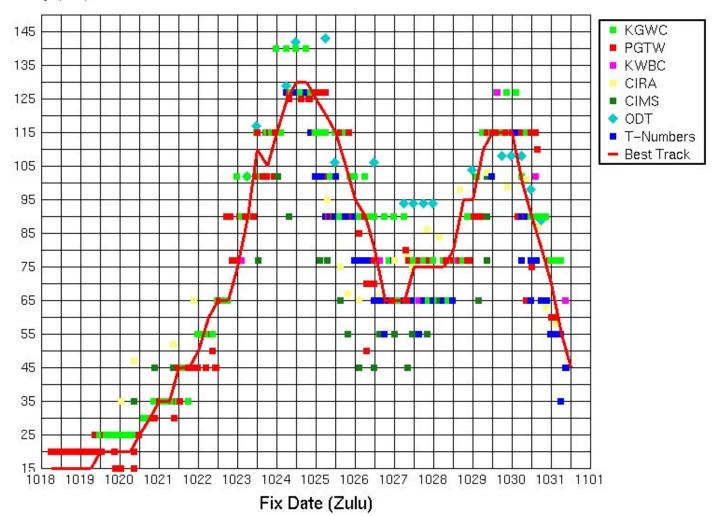


Figure 1-21W-3. 300315Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an intensity of 100 knots.

### TYPHOON 21W (PARMA) 20 - 31 OCTOBER 2003



## Time Intensity for 21W



## **Tropical Depression (TD) 22W**



First Poor: 1130Z 21 Oct 03

First Fair : 2300Z 21 Oct 03

First TCFA: 0600Z 22 Oct 03

First Warning: 0600Z 22 Oct 03

Last Warning: 1800Z 23 Oct 03, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: Near Iloilo, Philippines

Total Warnings: 07

#### Remarks:

- 1) Tropical Depression (TD) 22W was first identified as a well defined low level circulation center in the South China Sea and was rapidly upgraded to warning status 18 hours later. The cyclone tracked eastward into an environment of increasing vertical wind shear, failed to develop further and was finaled over land in the Philippines 36 hours after the first warning was issued.
- 2) No damage reports were received associated with this system.

|          |       |        | S      | tatist | ics | for . | JTW  | C on | TD      | 22 | W  |     |       |      |     |     |    |    |    |     |
|----------|-------|--------|--------|--------|-----|-------|------|------|---------|----|----|-----|-------|------|-----|-----|----|----|----|-----|
|          | MON   | DECT   |        |        | DO  | CITIO | ON E | DDO  | DC      |    |    |     | 10/11 | NID. | ГОГ | ROR | 00 |    |    |     |
|          | VVKIN | BEST T | RACK   |        | PU  | 21110 | ON E | KKU  | KS<br>— |    |    |     | VVII  | טוי  |     | KUR | (S |    |    |     |
| DTG      | NO.   | LAT    | LONG   | wind   | 00  | 12    | 24   | 36   | 48      | 72 | 96 | 120 | 00    | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 03102100 |       | 11.4N  | 112.4E | 25     |     |       |      |      |         |    |    |     |       |      |     |     |    |    |    |     |
| 03102106 |       | 11.7N  | 112.2E | 25     |     |       |      |      |         |    |    |     |       |      |     |     |    |    |    |     |
| 03102112 |       | 12.0N  | 112.5E | 25     |     |       |      |      |         |    |    |     |       |      |     |     |    |    |    |     |

| 00400440 |   | 44.001 | 440.05  | 0.5 |    |     |     |     |  |  |   |   |    |   |  |  |
|----------|---|--------|---------|-----|----|-----|-----|-----|--|--|---|---|----|---|--|--|
| 03102118 |   | 11.9N  | 113.3E  | 25  |    |     |     |     |  |  |   |   |    |   |  |  |
| 03102200 |   | 11.9N  | 114.1E  | 25  |    |     |     |     |  |  |   |   |    |   |  |  |
| 03102206 | 1 | 11.8N  | 114.9E  | 25  | 17 | 35  | 130 | 207 |  |  | 0 | 0 | 0  | 5 |  |  |
| 03102212 | 2 | 11.6N  | 115.8E  | 25  | 26 | 116 | 243 | 307 |  |  | 0 | 0 | 0  | 5 |  |  |
| 03102218 | 3 | 11.4N  | 116.7E  | 25  | 30 | 103 | 165 |     |  |  | 0 | 0 | 10 |   |  |  |
| 03102300 | 4 | 11.1N  | 117.9E  | 25  | 35 | 62  | 93  |     |  |  | 0 | 0 | 10 |   |  |  |
| 03102306 | 5 | 10.9N  | 119.2E  | 25  | 11 | 43  |     |     |  |  | 0 | 5 |    |   |  |  |
| 03102312 | 6 | 10.9N  | 120.6E  | 25  | 6  | 24  |     |     |  |  | 0 | 5 |    |   |  |  |
| 03102318 | 7 | 11.0N  | 121.4E  | 20  | 48 |     |     |     |  |  | 0 |   |    |   |  |  |
| 03102400 |   | 10.9N  | 122.1E  | 20  |    |     |     |     |  |  |   |   |    |   |  |  |
|          |   |        | AVERAGE |     | 25 | 64  | 158 | 257 |  |  | 0 | 2 | 5  | 5 |  |  |
|          |   |        | BIAS    |     |    |     |     |     |  |  | 0 | 2 | 5  | 5 |  |  |
|          |   |        | # CASES |     | 7  | 6   | 4   | 2   |  |  | 7 | 6 | 4  | 2 |  |  |

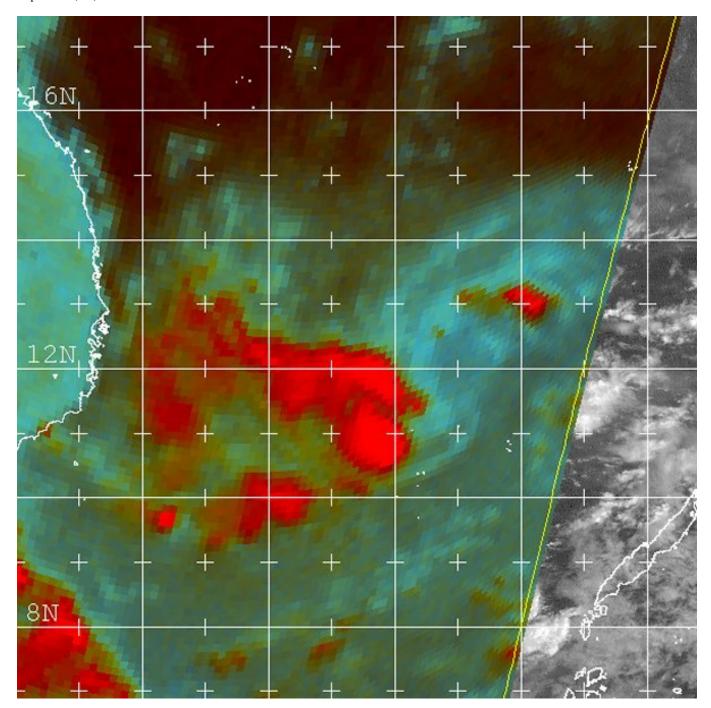
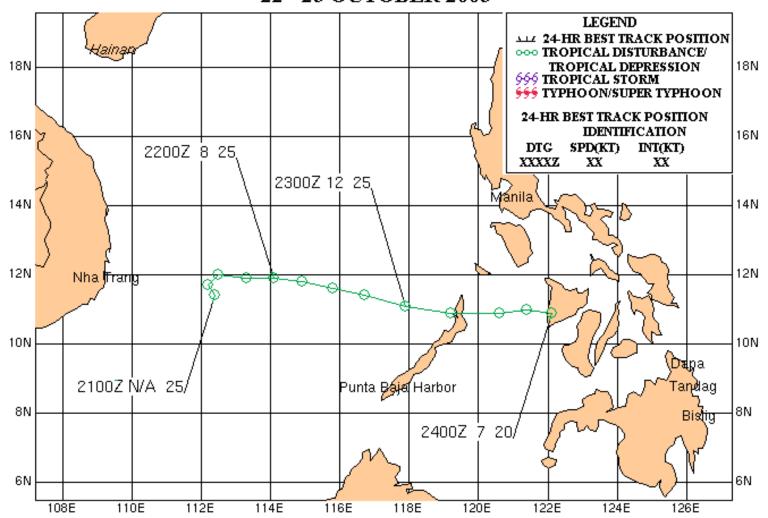
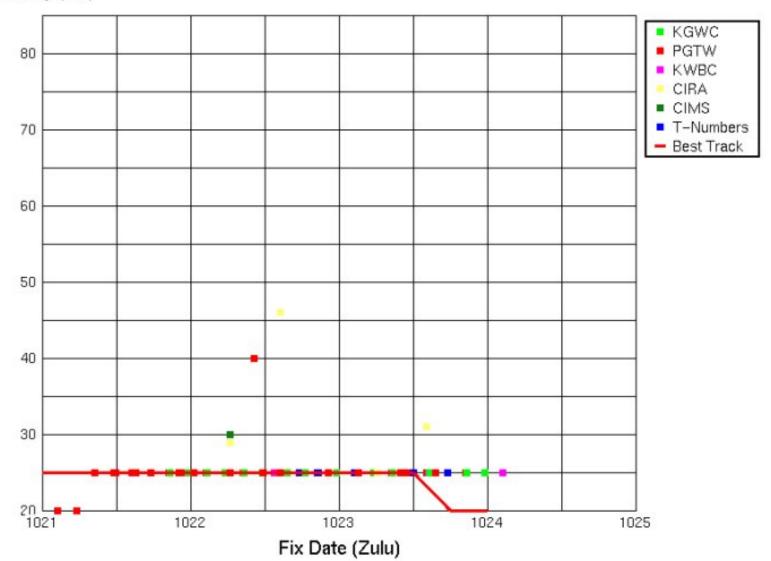


Figure 1-22W-1. 220031Z October 2003 color composite SSM/I satellite imagery of TY 22W, the partially exposed low level circulation center was located 330 nm southwest of Luzon, Philippines at its peak intensity of 25 knots.

### TROPICAL DEPRESSION 22W 22 - 23 OCTOBER 2003



# Time Intensity for 22W



## **Tropical Depression (TD) 22W**



First Poor: 1130Z 21 Oct 03

First Fair: 2300Z 21 Oct 03

First TCFA: 0600Z 22 Oct 03

First Warning: 0600Z 22 Oct 03

Last Warning: 1800Z 23 Oct 03, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: Near Iloilo, Philippines

Total Warnings: 07

#### Remarks:

- 1) Tropical Depression (TD) 22W was first identified as a well defined low level circulation center in the South China Sea and was rapidly upgraded to warning status 18 hours later. The cyclone tracked eastward into an environment of increasing vertical wind shear, failed to develop further and was finaled over land in the Philippines 36 hours after the first warning was issued.
- 2) No damage reports were received associated with this system.

|          |     |        | S      | tatist | ics | for . | JTW  | C on | TC | 22 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|--------|--------|--------|-----|-------|------|------|----|----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          | WRN | BEST T | TRACK  |        | PC  | SITI  | ON E | RRO  | RS |    |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00  | 12    | 24   | 36   | 48 | 72 | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03102100 |     | 11.4N  | 112.4E | 25     |     |       |      |      |    |    |    |     |     |    |     |     |    |    |    |     |
| 03102106 |     | 11.7N  | 112.2E | 25     |     |       |      |      |    |    |    |     |     |    |     |     |    |    |    |     |
| 03102112 |     | 12.0N  | 112.5E | 25     |     |       |      |      |    |    |    |     |     |    |     |     |    |    |    |     |
| 03102118 |     | 11.9N  | 113.3E | 25     |     |       |      |      |    |    |    |     |     |    |     |     |    |    |    |     |

| 03102200 |   | 11.9N | 114.1E  | 25 |    |     |     |     |  |  |   |   |    |   |  |  |
|----------|---|-------|---------|----|----|-----|-----|-----|--|--|---|---|----|---|--|--|
| 03102206 | 1 | 11.8N | 114.9E  | 25 | 17 | 35  | 130 | 207 |  |  | 0 | 0 | 0  | 5 |  |  |
| 03102212 | 2 | 11.6N | 115.8E  | 25 | 26 | 116 | 243 | 307 |  |  | 0 | 0 | 0  | 5 |  |  |
| 03102218 | 3 | 11.4N | 116.7E  | 25 | 30 | 103 | 165 |     |  |  | 0 | 0 | 10 |   |  |  |
| 03102300 | 4 | 11.1N | 117.9E  | 25 | 35 | 62  | 93  |     |  |  | 0 | 0 | 10 |   |  |  |
| 03102306 | 5 | 10.9N | 119.2E  | 25 | 11 | 43  |     |     |  |  | 0 | 5 |    |   |  |  |
| 03102312 | 6 | 10.9N | 120.6E  | 25 | 6  | 24  |     |     |  |  | 0 | 5 |    |   |  |  |
| 03102318 | 7 | 11.0N | 121.4E  | 20 | 48 |     |     |     |  |  | 0 |   |    |   |  |  |
| 03102400 |   | 10.9N | 122.1E  | 20 |    |     |     |     |  |  |   |   |    |   |  |  |
|          |   |       | AVERAGE |    | 25 | 64  | 158 | 257 |  |  | 0 | 2 | 5  | 5 |  |  |
|          |   |       | BIAS    |    |    |     |     |     |  |  | 0 | 2 | 5  | 5 |  |  |
|          |   |       | # CASES |    | 7  | 6   | 4   | 2   |  |  | 7 | 6 | 4  | 2 |  |  |

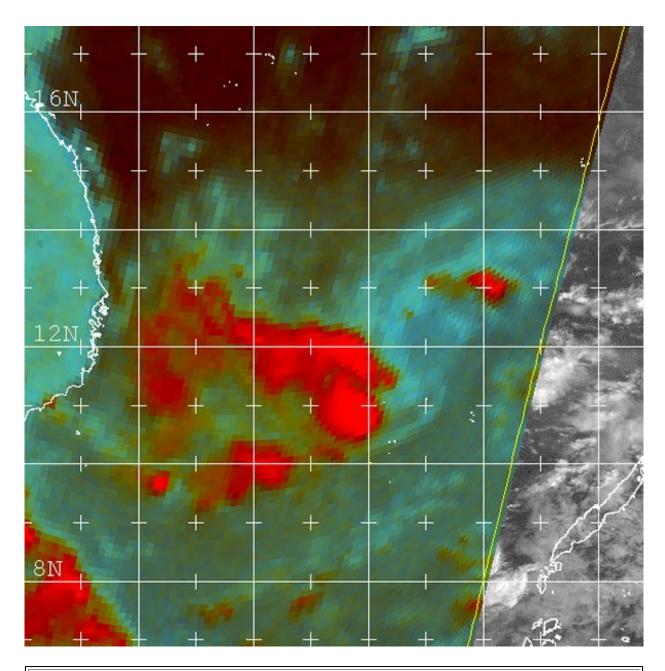
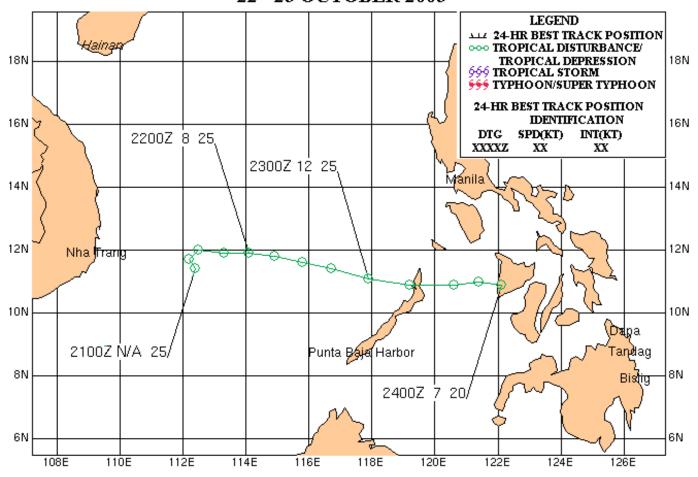
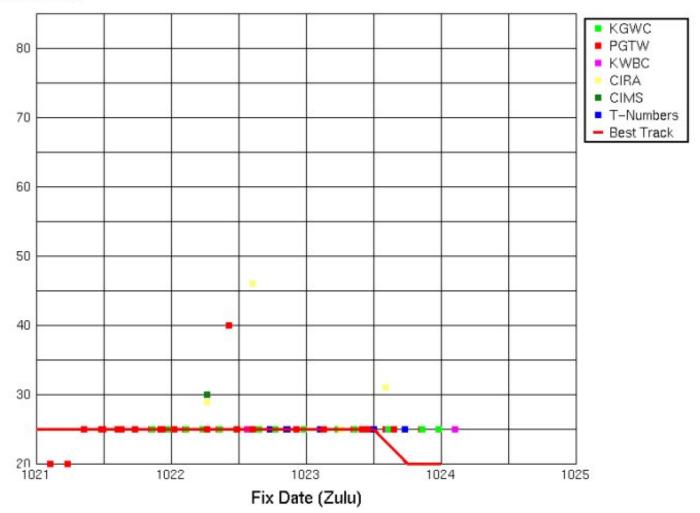


Figure 1-22W-1. 220031Z October 2003 color composite SSM/I satellite imagery of TY 22W, the partially exposed low level circulation center was located 330 nm southwest of Luzon, Philippines at its peak intensity of 25 knots.

### TROPICAL DEPRESSION 22W 22 - 23 OCTOBER 2003



# Time Intensity for 22W



## **Tropical Storm (TS) 23W**



First Poor: N/A

First Fair: 1700Z 21 Oct 03

First TCFA: 2330Z 21 Oct 03

First Warning: 0600Z 23 Oct 03

Last Warning: 0600Z 08 Nov 03

Max Intensity: 35 kts, gusts to 45 kts

Landfall: N/A

Total Warnings: 14

Remarks:

1) Tropical Storm (TS) 23W developed in the monsoon trough in the Gulf of Thailand, then crossed the Isthmus of Kra to move through the Bay of Bengal with tropical storm intensity, following an unusual course of development and tracking. The cyclone subsequently made landfall northwest of Visakhaptnam, India.

Weather observations from oil platforms in the Gulf of Thailand were instrumental in determining the presence and intensity fo the cyclone during the initial period of development.

2) No damage reports were received for this cyclone.

|          |     |      | ,      | Statis | tics | s fo | r JT | WC ( | on T | S23 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|------|--------|--------|------|------|------|------|------|-----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     |      |        |        |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
|          | WRN | BEST | TRACK  |        | РО   | SIT  | ION  | ERR  | ORS  |     |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT  | LONG   | wind   | 00   | 12   | 24   | 36   | 48   | 72  | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03102112 |     | 9.1N | 101.4E | 25     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102118 |     | 9.4N | 101.4E | 25     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102200 |     | 9.5N | 101.4E | 25     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102206 |     | 9.6N | 101.4E | 25     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102212 |     | 9.7N | 101.3E | 30     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102218 |     | 9.9N | 101.3E | 25     |      |      |      |      |      |     |    |     |     |    |     |     |    |    |    |     |

| 03102300 |    | 10.1N | 101.1E  | 25 |    |    |     |     |     |     |    |    |    |    |    |    |  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|--|
| 03102306 | 1  | 10.4N | 101.0E  | 25 | 31 | 50 | 106 | 139 | 88  | 91  | 0  | 5  | 10 | 15 | 20 | 25 |  |
| 03102312 | 2  | 10.7N | 101.0E  | 25 | 29 | 46 | 73  | 67  | 48  | 26  | 0  | 5  | 10 | 15 | 20 | 25 |  |
| 03102318 | 3  | 11.0N | 101.1E  | 25 | 8  | 34 | 51  | 48  | 89  | 112 | 0  | 5  | 10 | 15 | 20 | 20 |  |
| 03102400 | 4  | 11.4N | 101.0E  | 25 | 11 | 38 | 18  | 61  | 74  | 125 | 0  | 5  | 5  | 15 | 20 | 15 |  |
| 03102406 | 5  | 11.7N | 100.8E  | 25 | 18 | 42 | 60  | 93  | 123 | 214 | 0  | 5  | 10 | 15 | 20 | 15 |  |
| 03102412 | 6  | 12.1N | 100.3E  | 25 | 8  | 23 | 82  | 111 | 121 | 256 | 0  | 5  | 10 | 15 | 20 | 15 |  |
| 03102418 | 7  | 12.5N | 99.6E   | 25 | 6  | 63 | 96  | 114 | 155 |     | 0  | 5  | 10 | 15 | 15 |    |  |
| 03102506 | 8  | 12.5N | 97.4E   | 25 | 0  | 39 | 36  | 63  | 104 |     | 0  | 0  | 5  | 10 | 10 |    |  |
| 03102518 | 9  | 13.2N | 95.1E   | 25 | 8  | 35 | 68  | 74  | 100 |     | 0  | 5  | 5  | 5  | 10 |    |  |
| 03102606 | 10 | 13.3N | 93.3E   | 25 | 24 | 36 | 50  | 86  | 84  |     | 0  | 0  | 0  | 5  | 15 |    |  |
| 03102618 | 11 | 13.6N | 91.4E   | 30 | 0  | 30 | 81  | 100 |     |     | 0  | 0  | 10 | 15 |    |    |  |
| 03102706 | 12 | 14.6N | 88.9E   | 35 | 0  | 71 | 117 |     |     |     | 0  | 5  | 15 |    |    |    |  |
| 03102718 | 13 | 16.3N | 86.0E   | 35 | 37 | 12 |     |     |     |     | 0  | 10 |    |    |    |    |  |
| 03102806 | 14 | 18.2N | 84.0E   | 30 | 0  |    |     |     |     |     | 0  |    |    |    |    |    |  |
| 03102812 |    | 18.7N | 83.4E   | 30 |    |    |     |     |     |     |    |    |    |    |    |    |  |
|          |    |       | AVERAGE |    | 13 | 40 | 70  | 87  | 99  | 137 | 0  | 4  | 8  | 13 | 17 | 19 |  |
|          |    |       | BIAS    |    |    |    |     |     |     |     | 0  | 4  | 8  | 13 | 17 | 19 |  |
|          |    |       | # CASES |    | 14 | 13 | 12  | 11  | 10  | 6   | 14 | 13 | 12 | 11 | 10 | 6  |  |

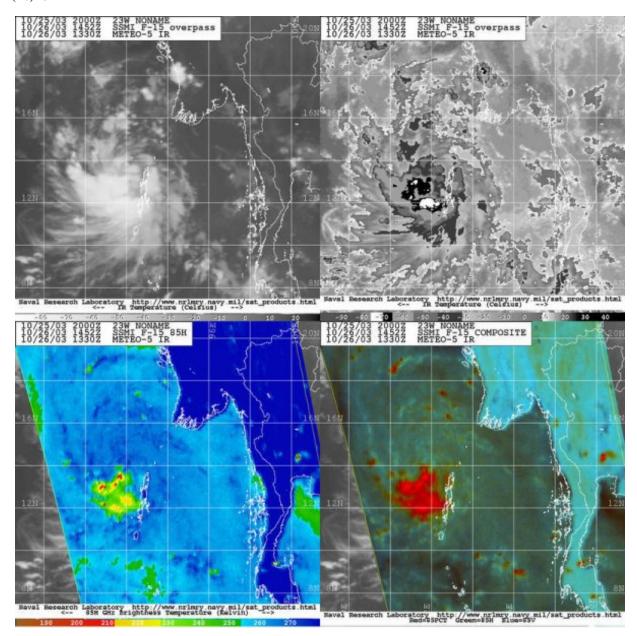
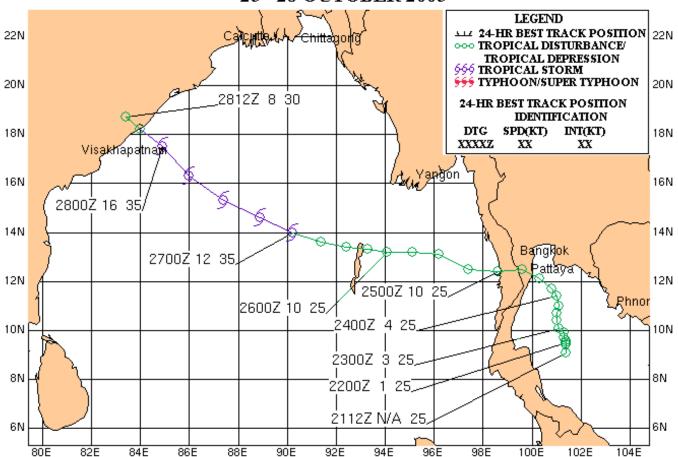
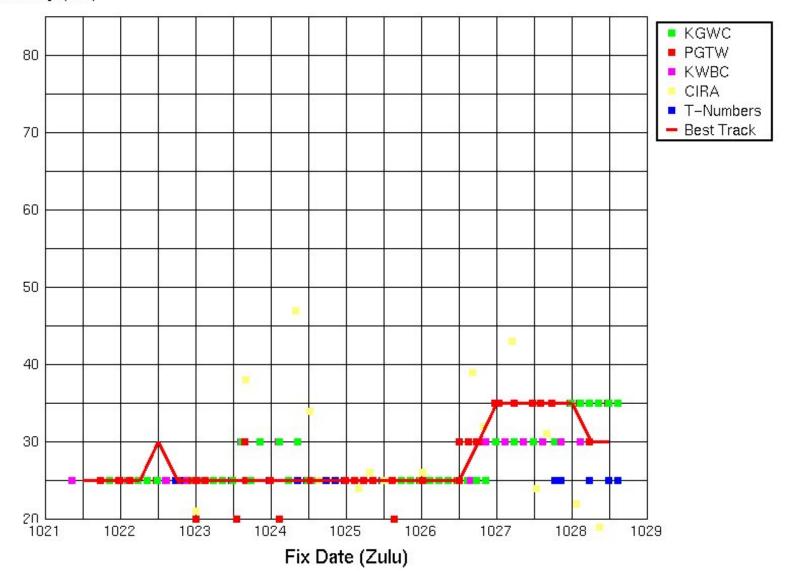


Figure 1-23W-1. 261452Z October 2003 multi-sensor satellite imagery of TY 23W, the partially exposed low level circulation center was located 20 nm west of Maldive island at an intensity of 25 knots.

### TROPICAL STORM 23W 23 - 28 OCTOBER 2003



# Time Intensity for 23W



## **Tropical Storm (TS) 23W**



First Poor: N/A

First Fair: 1700Z 21 Oct 03

First TCFA: 2330Z 21 Oct 03

First Warning: 0600Z 23 Oct 03

Last Warning: 0600Z 08 Nov 03

Max Intensity: 35 kts, gusts to 45 kts

Landfall: N/A

Total Warnings: 14

#### Remarks:

1) Tropical Storm (TS) 23W developed in the monsoon trough in the Gulf of Thailand, then crossed the Isthmus of Kra to move through the Bay of Bengal with tropical storm intensity, following an unusual course of development and tracking. The cyclone subsequently made landfall northwest of Visakhaptnam, India.

Weather observations from oil platforms in the Gulf of Thailand were instrumental in determining the presence and intensity fo the cyclone during the initial period of development.

2) No damage reports were received for this cyclone.

|          |     |       |        | Statis | tics | s fo | r JT | WC  | on T | S23 | W  |     |     |    |     |     |    |    |    |     |
|----------|-----|-------|--------|--------|------|------|------|-----|------|-----|----|-----|-----|----|-----|-----|----|----|----|-----|
|          |     |       |        |        |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
|          | WRN | BEST  | TRACK  |        | РО   | SIT  | ION  | ERR | ORS  |     |    |     | WII | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT   | LONG   | wind   | 00   | 12   | 24   | 36  | 48   | 72  | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03102112 |     | 9.1N  | 101.4E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102118 |     | 9.4N  | 101.4E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102200 |     | 9.5N  | 101.4E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102206 |     | 9.6N  | 101.4E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102212 |     | 9.7N  | 101.3E | 30     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102218 |     | 9.9N  | 101.3E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |
| 03102300 |     | 10.1N | 101.1E | 25     |      |      |      |     |      |     |    |     |     |    |     |     |    |    |    |     |

| 03102306 | 1  | 10.4N | 101.0E  | 25 | 31 | 50 | 106 | 139 | 88  | 91  | 0  | 5  | 10 | 15 | 20 | 25 |  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|--|
| 03102312 | 2  | 10.7N | 101.0E  | 25 | 29 | 46 | 73  | 67  | 48  | 26  | 0  | 5  | 10 | 15 | 20 | 25 |  |
| 03102318 | 3  | 11.0N | 101.1E  | 25 | 8  | 34 | 51  | 48  | 89  | 112 | 0  | 5  | 10 | 15 | 20 | 20 |  |
| 03102400 | 4  | 11.4N | 101.0E  | 25 | 11 | 38 | 18  | 61  | 74  | 125 | 0  | 5  | 5  | 15 | 20 | 15 |  |
| 03102406 | 5  | 11.7N | 100.8E  | 25 | 18 | 42 | 60  | 93  | 123 | 214 | 0  | 5  | 10 | 15 | 20 | 15 |  |
| 03102412 | 6  | 12.1N | 100.3E  | 25 | 8  | 23 | 82  | 111 | 121 | 256 | 0  | 5  | 10 | 15 | 20 | 15 |  |
| 03102418 | 7  | 12.5N | 99.6E   | 25 | 6  | 63 | 96  | 114 | 155 |     | 0  | 5  | 10 | 15 | 15 |    |  |
| 03102506 | 8  | 12.5N | 97.4E   | 25 | 0  | 39 | 36  | 63  | 104 |     | 0  | 0  | 5  | 10 | 10 |    |  |
| 03102518 | 9  | 13.2N | 95.1E   | 25 | 8  | 35 | 68  | 74  | 100 |     | 0  | 5  | 5  | 5  | 10 |    |  |
| 03102606 | 10 | 13.3N | 93.3E   | 25 | 24 | 36 | 50  | 86  | 84  |     | 0  | 0  | 0  | 5  | 15 |    |  |
| 03102618 | 11 | 13.6N | 91.4E   | 30 | 0  | 30 | 81  | 100 |     |     | 0  | 0  | 10 | 15 |    |    |  |
| 03102706 | 12 | 14.6N | 88.9E   | 35 | 0  | 71 | 117 |     |     |     | 0  | 5  | 15 |    |    |    |  |
| 03102718 | 13 | 16.3N | 86.0E   | 35 | 37 | 12 |     |     |     |     | 0  | 10 |    |    |    |    |  |
| 03102806 | 14 | 18.2N | 84.0E   | 30 | 0  |    |     |     |     |     | 0  |    |    |    |    |    |  |
| 03102812 |    | 18.7N | 83.4E   | 30 |    |    |     |     |     |     |    |    |    |    |    |    |  |
|          |    |       | AVERAGE |    | 13 | 40 | 70  | 87  | 99  | 137 | 0  | 4  | 8  | 13 | 17 | 19 |  |
|          |    |       | BIAS    |    |    |    |     |     |     |     | 0  | 4  | 8  | 13 | 17 | 19 |  |
|          |    |       | # CASES |    | 14 | 13 | 12  | 11  | 10  | 6   | 14 | 13 | 12 | 11 | 10 | 6  |  |

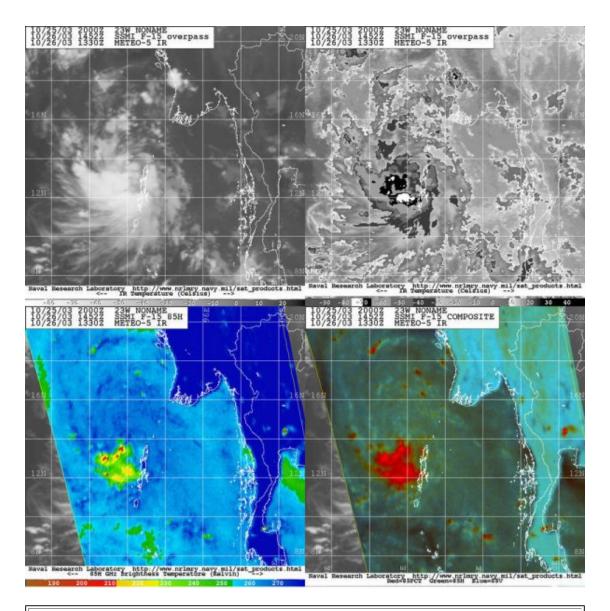
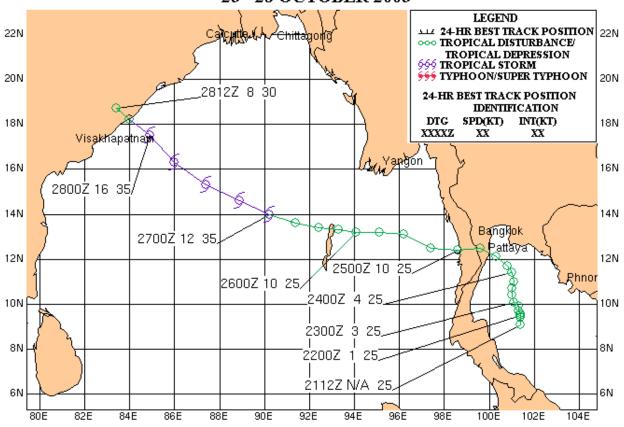
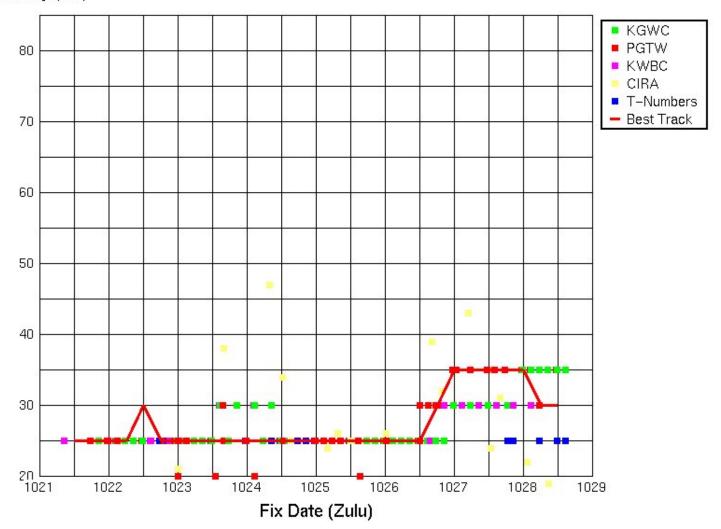


Figure 1-23W-1. 261452Z October 2003 multi-sensor satellite imagery of TY 23W, the partially exposed low level circulation center was located 20 nm west of Maldive island at an intensity of 25 knots.

#### TROPICAL STORM 23W 23 - 28 OCTOBER 2003



# Time Intensity for 23W



## Typhoon (TY) 24W (Melor)\*



First Poor: 0600Z 28 Oct 03

First Fair: 1430Z 28 Oct 03

First TCFA: 0330Z 30 Oct 03

First Warning: 0300Z 30 Oct 03

Last Warning: 0000Z 04 Nov 03, Extratropical

Max Intensity: 70 kts, gusts to 85 kts

Landfall: Luzon

Total Warnings: 20

#### Remarks:

1) Typhoon (TY) 24W was noted as a tropical disturbance north-northeast of Palau on the tropical weather advisory on 28 October, 2003. Located in an area of moderate vertical wind shear and relatively weak upper level diffluence, the cyclone developed slowly for 48 hours. The vertical wind shear decreased by 0000Z on 30 October, at which time the rate of development increased and a first warning was issued by 0300Z on 30 October.

TY 24W steering was influenced by a low to mid-level ridge to the east of the system, creating a westnorthwestward track. Intensification was slightly greater than the climatological mean, with 1.5 Dvorak Tnumber/day intensification rate for approximately 48 hours after the first warning.

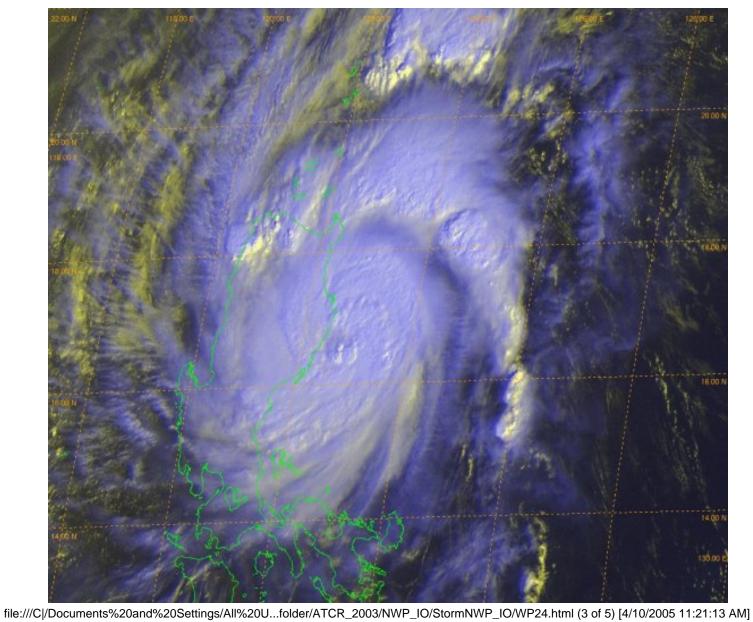
At approximately 0000Z on 01 November, TY 24W made landfall south of Palanan, Luzon, Philippines with maximum intensity of 75 knots. TY 24W subsequently weakened due to land interaction and altered track toward the northwest. The cyclone moved over open water, north of Luzon, along the western periphery of the mid-level ridge to the east.

By 0000Z on 2 November, TY 24W began to move more northward as it passed the axis of the steering ridge. After 12 hours of north movement, the cyclone began extratropical transition, which was completed by 0000Z on 4 November, when the final warning was issued.

2) No reports of damage were received on this cyclone.

|          |      |        |        | Stati | stic | s f | or J | TWC | on  | TY2        | 24W |     |    |         |         |         |         |         |         |     |
|----------|------|--------|--------|-------|------|-----|------|-----|-----|------------|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
|          | WRN  | BEST T | TRACK  |       | PC   | SIT | ION  | ERR | ORS |            |     |     | WI | ND      | FRF     | ROR     | S       |         |         |     |
| DTG      | NO.  | LAT    | LONG   | wind  |      |     |      | 36  | 48  | 72         | 96  | 120 |    |         |         |         |         | 72      | 96      | 120 |
| 03102818 | 110. | 11.4N  | 133.1E | 15    | 00   | 12  | _ '  | 00  | 10  | , <u>~</u> |     | 120 |    | 12      |         |         | 10      | -       |         | 120 |
| 03102900 |      | 11.6N  | 132.4E | 15    |      |     |      |     |     |            |     |     |    |         |         |         |         |         |         |     |
| 03102906 |      | 11.8N  | 131.7E | 15    |      |     |      |     |     |            |     |     |    |         |         |         |         |         |         |     |
| 03102912 |      |        | 130.9E | 15    |      |     |      |     |     |            |     |     |    |         |         |         |         |         |         |     |
| 03102918 |      | 12.3N  | 130.2E | 25    |      |     |      |     |     |            |     |     |    |         |         |         |         |         |         |     |
| 03103000 |      | 12.6N  | 129.4E | 25    |      |     |      |     |     |            |     |     |    |         |         |         |         |         |         |     |
| 03103006 | 1    | 13.0N  | 128.7E | 25    | 8    | 25  | 68   | 86  | 67  | 19         |     |     | 0  | -5      | -<br>15 | -<br>25 | -<br>25 | -<br>15 |         |     |
| 03103012 | 2    | 13.5N  | 127.8E | 35    | 11   | 46  | 94   | 63  | 51  | 67         | 212 |     | 0  | -<br>10 | -<br>25 | -<br>30 | -<br>20 | -<br>25 | -<br>20 |     |
| 03103018 | 3    | 14.0N  | 126.9E | 35    | 5    | 6   | 13   | 31  | 51  | 272        | 528 |     | 0  | -5      | -<br>15 | -<br>15 | 0       | -<br>10 | -<br>20 |     |
| 03103100 | 4    | 14.7N  | 125.9E | 45    | 13   | 48  | 32   | 0   | 91  | 337        | 566 |     | 0  | -5      | -<br>10 | 5       | 15      | 20      | 15      |     |
| 03103106 | 5    | 15.3N  | 124.7E | 50    | 5    | 38  | 36   | 38  | 103 | 319        |     |     | 0  | 0       | -<br>10 | 0       | 10      | 15      |         |     |
| 03103112 | 6    | 15.9N  | 123.6E | 65    | 13   | 31  | 13   | 54  | 100 | 296        |     |     | 0  | 0       | 0       | 15      | 10      | 15      |         |     |
| 03103118 | 7    | 16.4N  | 122.9E | 65    | 6    | 29  | 83   | 127 | 215 | 432        |     |     | 0  | -<br>15 | -5      | 5       | 5       | 5       |         |     |
| 03110100 | 8    | 16.8N  | 122.4E | 75    | 0    | 55  | 106  | 177 | 295 | 495        |     |     | -5 | -5      | 5       | 10      | 15      | 10      |         |     |
| 03110106 | 9    | 17.6N  | 121.8E | 70    | 26   | 84  | 127  | 214 | 338 |            |     |     | 5  | 0       | 10      | 15      | 15      |         |         |     |
| 03110112 | 10   | 18.7N  | 121.0E | 65    | 6    | 54  | 130  | 264 | 378 |            |     |     | 10 | 10      | 15      | 20      | 10      |         |         |     |
| 03110118 | 11   | 19.5N  | 120.8E | 65    | 0    | 18  | 92   | 223 | 328 |            |     |     | 0  | 5       | 5       | 10      | 0       |         |         |     |
| 03110200 | 12   | 20.1N  | 120.7E | 60    | 8    | 29  | 121  | 224 | 295 |            |     |     | 0  | -5      | 5       | 0       | 0       |         |         |     |
| 03110206 | 13   | 20.7N  | 120.6E | 60    | 5    | 66  | 162  | 235 |     |            |     |     | 0  | 0       | 5       | -5      |         |         |         |     |
| 03110212 | 14   | 21.3N  | 120.8E | 60    | 11   | 86  | 180  | 264 |     |            |     |     | 0  | 10      | 0       | 5       |         |         |         |     |
| 03110218 | 15   | 22.0N  | 121.3E | 55    | 5    | 50  | 74   |     |     |            |     |     | 0  | 0       | -<br>10 |         |         |         |         |     |
| 03110300 | 16   | 22.7N  | 121.9E | 45    | 11   | 53  | 95   |     |     |            |     |     | 0  | -<br>10 | 10      |         |         |         |         |     |

| 03110306 | 17 | 23.1N | 122.6E  | 45 | 16 | 47 |    |     |     |     |     | 0  | -<br>10 |    |    |    |    |    |  |
|----------|----|-------|---------|----|----|----|----|-----|-----|-----|-----|----|---------|----|----|----|----|----|--|
| 03110312 | 18 | 23.4N | 123.1E  | 45 | 21 | 97 |    |     |     |     |     | 0  | 0       |    |    |    |    |    |  |
| 03110318 | 19 | 23.5N | 123.3E  | 45 | 77 |    |    |     |     |     |     | 0  |         |    |    |    |    |    |  |
| 03110400 | 20 | 23.6N | 123.5E  | 35 | 28 |    |    |     |     |     |     | 0  |         |    |    |    |    |    |  |
|          |    |       | AVERAGE |    | 14 | 48 | 89 | 143 | 193 | 280 | 435 | 1  | 5       | 9  | 11 | 10 | 14 | 18 |  |
|          |    |       | BIAS    |    |    |    |    |     |     |     |     | 1  | -3      | -3 | 1  | 3  | 2  | -8 |  |
|          |    |       | # CASES |    | 20 | 18 | 16 | 14  | 12  | 8   | 3   | 20 | 18      | 16 | 14 | 12 | 8  | 3  |  |



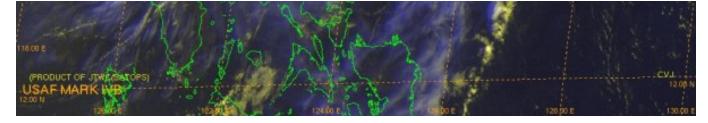
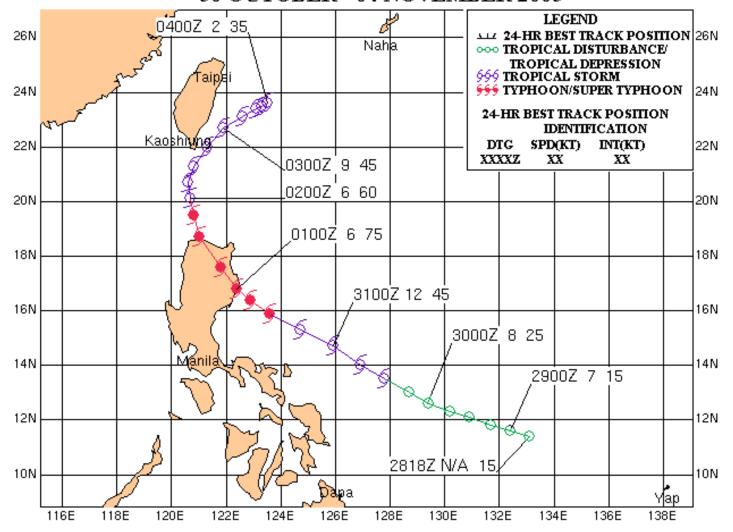
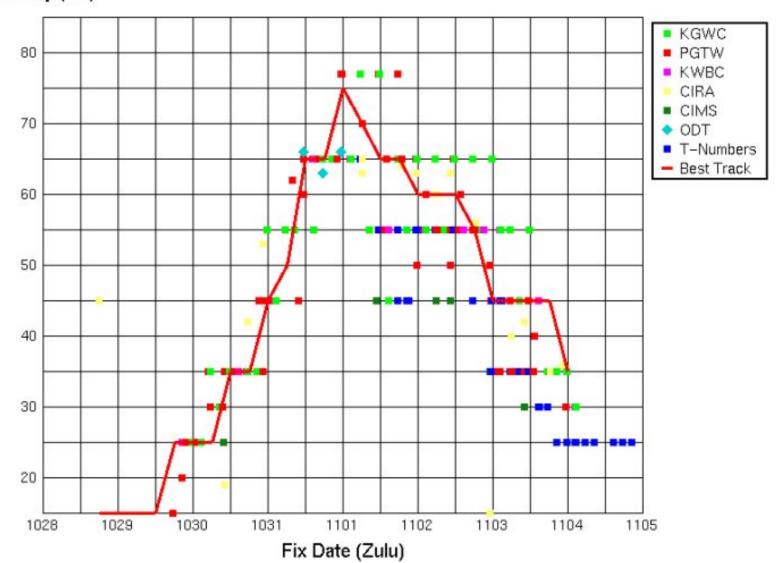


Figure 1-24W-1. 312325Z October 2003 multi-spectral satellite imagery of TY 24W, the eye was located on the coast of Luzon, Philippines at its peak intensity of 75 knots.

### TYPHOON 24W (MELOR) 30 OCTOBER - 04 NOVEMBER 2003



# Time Intensity for 24W



## Typhoon (TY) 24W (Melor)\*



First Poor: 0600Z 28 Oct 03

First Fair: 1430Z 28 Oct 03

First TCFA: 0330Z 30 Oct 03

First Warning: 0300Z 30 Oct 03

Last Warning: 0000Z 04 Nov 03, Extratropical

Max Intensity: 70 kts, gusts to 85 kts

Landfall: Luzon

Total Warnings: 20

#### Remarks:

1) Typhoon (TY) 24W was noted as a tropical disturbance north-northeast of Palau on the tropical weather advisory on 28 October, 2003. Located in an area of moderate vertical wind shear and relatively weak upper level diffluence, the cyclone developed slowly for 48 hours. The vertical wind shear decreased by 0000Z on 30 October, at which time the rate of development increased and a first warning was issued by 0300Z on 30 October.

TY 24W steering was influenced by a low to mid-level ridge to the east of the system, creating a west-northwestward track. Intensification was slightly greater than the climatological mean, with 1.5 Dvorak T-number/day intensification rate for approximately 48 hours after the first warning.

At approximately 0000Z on 01 November, TY 24W made landfall south of Palanan, Luzon, Philippines with maximum intensity of 75 knots. TY 24W subsequently weakened due to land interaction and altered track toward the northwest. The cyclone moved over open water, north of Luzon, along the western periphery of the mid-level ridge to the east.

By 0000Z on 2 November, TY 24W began to move more northward as it passed the axis of the steering ridge. After 12 hours of north movement, the cyclone began extratropical transition, which was completed by 0000Z on 4 November, when the final warning was issued.

2) No reports of damage were received on this cyclone.

# Statistics for JTWC on TY24W

|          | WRN | BEST  | TRACK   |      | PC | SIT | ION | ERR | ORS | 3   |     |     | WI | ND      | ERF     | ROR     | S       |         |         |     |
|----------|-----|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03102818 |     | 11.4N | 133.1E  | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102900 |     | 11.6N | 132.4E  | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102906 |     | 11.8N | 131.7E  | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102912 |     | 12.1N | 130.9E  | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03102918 |     | 12.3N | 130.2E  | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03103000 |     | 12.6N | 129.4E  | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03103006 | 1   | 13.0N | 128.7E  | 25   | 8  | 25  | 68  | 86  | 67  | 19  |     |     | 0  | -5      | -<br>15 | -<br>25 | -<br>25 | -<br>15 |         |     |
| 03103012 | 2   | 13.5N | 127.8E  | 35   | 11 | 46  | 94  | 63  | 51  | 67  | 212 |     | 0  | -<br>10 | -<br>25 | -<br>30 | -<br>20 | -<br>25 | -<br>20 |     |
| 03103018 | 3   | 14.0N | 126.9E  | 35   | 5  | 6   | 13  | 31  | 51  | 272 | 528 |     | 0  | -5      | -<br>15 | -<br>15 | 0       | -<br>10 | -<br>20 |     |
| 03103100 | 4   | 14.7N | 125.9E  | 45   | 13 | 48  | 32  | 0   | 91  | 337 | 566 |     | 0  | -5      | -<br>10 | 5       | 15      | 20      | 15      |     |
| 03103106 | 5   | 15.3N | 124.7E  | 50   | 5  | 38  | 36  | 38  | 103 | 319 |     |     | 0  | 0       | -<br>10 | 0       | 10      | 15      |         |     |
| 03103112 | 6   | 15.9N | 123.6E  | 65   | 13 | 31  | 13  | 54  | 100 | 296 |     |     | 0  | 0       | 0       | 15      | 10      | 15      |         |     |
| 03103118 | 7   | 16.4N | 122.9E  | 65   | 6  | 29  | 83  | 127 | 215 | 432 |     |     | 0  | -<br>15 | -5      | 5       | 5       | 5       |         |     |
| 03110100 | 8   | 16.8N | 122.4E  | 75   | 0  | 55  | 106 | 177 | 295 | 495 |     |     | -5 | -5      | 5       | 10      | 15      | 10      |         |     |
| 03110106 | 9   | 17.6N | 121.8E  | 70   | 26 | 84  | 127 | 214 | 338 |     |     |     | 5  | 0       | 10      | 15      | 15      |         |         |     |
| 03110112 | 10  | 18.7N | 121.0E  | 65   | 6  | 54  | 130 | 264 | 378 |     |     |     | 10 | 10      | 15      | 20      | 10      |         |         |     |
| 03110118 | 11  | 19.5N | 120.8E  | 65   | 0  | 18  | 92  | 223 | 328 |     |     |     | 0  | 5       | 5       | 10      | 0       |         |         |     |
| 03110200 | 12  | 20.1N | 120.7E  | 60   | 8  | 29  | 121 | 224 | 295 |     |     |     | 0  | -5      | 5       | 0       | 0       |         |         |     |
| 03110206 | 13  | 20.7N | 120.6E  | 60   | 5  | 66  | 162 | 235 |     |     |     |     | 0  | 0       | 5       | -5      |         |         |         |     |
| 03110212 | 14  | 21.3N | 120.8E  | 60   | 11 | 86  | 180 | 264 |     |     |     |     | 0  | 10      | 0       | 5       |         |         |         |     |
| 03110218 | 15  | 22.0N | 121.3E  | 55   | 5  | 50  | 74  |     |     |     |     |     | 0  | 0       | -<br>10 |         |         |         |         |     |
| 03110300 | 16  | 22.7N | 121.9E  | 45   | 11 | 53  | 95  |     |     |     |     |     | 0  | -<br>10 | -<br>10 |         |         |         |         |     |
| 03110306 | 17  | 23.1N | 122.6E  | 45   | 16 | 47  |     |     |     |     |     |     | 0  | -<br>10 |         |         |         |         |         |     |
| 03110312 | 18  | 23.4N | 123.1E  | 45   | 21 | 97  |     |     |     |     |     |     | 0  | 0       |         |         |         |         |         |     |
| 03110318 | 19  | 23.5N | 123.3E  | 45   | 77 |     |     |     |     |     |     |     | 0  |         |         |         |         |         |         |     |
| 03110400 | 20  | 23.6N | 123.5E  | 35   | 28 |     |     |     |     |     |     |     | 0  |         |         |         |         |         |         |     |
|          |     |       | AVERAGE |      | 14 | 48  | 89  | 143 | 193 | 280 | 435 |     | 1  | 5       | 9       | 11      | 10      | 14      | 18      |     |

|  | BIAS    |    |    |    |    |    |   |   | 1  | -3 | -3 | 1  | 3  | 2 | -8 |  |
|--|---------|----|----|----|----|----|---|---|----|----|----|----|----|---|----|--|
|  | # CASES | 20 | 18 | 16 | 14 | 12 | 8 | 3 | 20 | 18 | 16 | 14 | 12 | 8 | 3  |  |

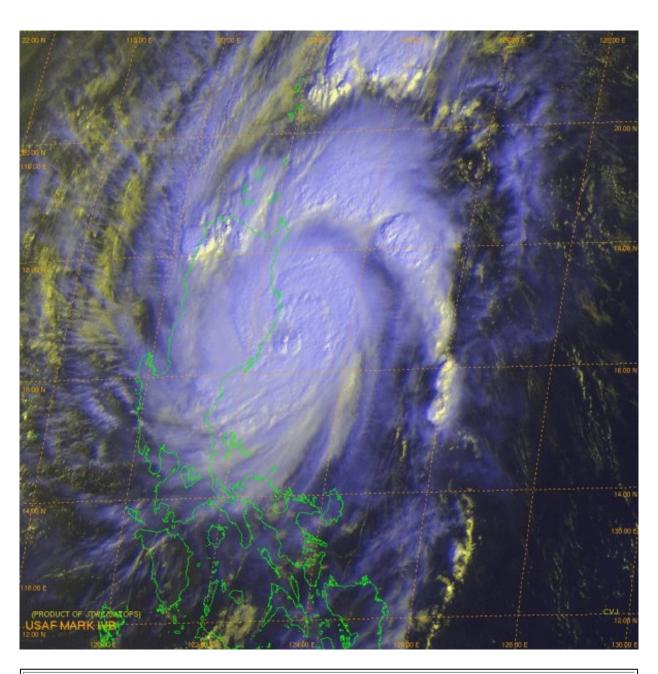
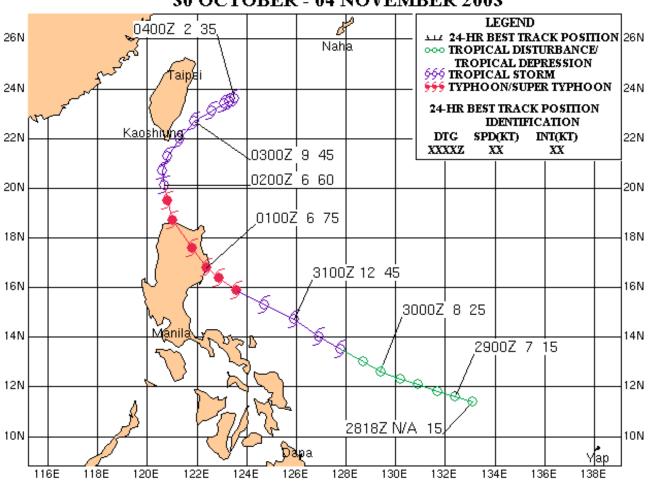
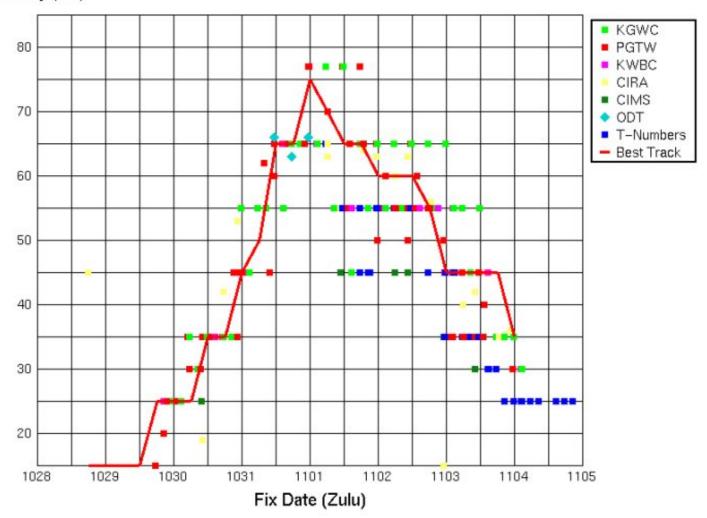


Figure 1-24W-1. 312325Z October 2003 multi-spectral satellite imagery of TY 24W, the eye was located on the coast of Luzon, Philippines at its peak intensity of 75 knots.

#### TYPHOON 24W (MELOR) 30 OCTOBER - 04 NOVEMBER 2003



# Time Intensity for 24W



## Typhoon (TY) 25W (Nepartak)\*



First Poor: 0000Z 11 Nov 03

First Fair: 1130Z 11 Nov 03

First TCFA: 2030Z 11 Nov 03

First Warning: 1200Z 12 Nov 03

Last Warning: 1200Z 19 Nov 03, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: Central Philippines, Hainan Island and Beihai, China

Total Warnings: 29

#### Remarks:

1) Typhoon (TY) 25W was first noted as an area of deep convection over broad surface troughing around 11 November northeast of Yap. After the cyclone developed and the first warning was issued, the cyclone began moving westward in response to the subtropical ridge situated to the north. As TY 08W tracked westward over the Philippines, land effects resulted in a brief period of weakening, however re-intensification occurred over open water in the South China Sea.

By 0600Z on 16 November, TY 25W began tracking more poleward, along the western periphery of the steering ridge, subsequently making landfall a second time along the southwest coast of Hainan Island. A third and final landfall occurred on the south coast of China at around 1100Z on 19 November. The cyclone dissipated rapidly and a final warning was issued by 1200Z on 19 November.

While TY 25W attained a maximum intensity of 75 knots, no well-formed eye was ever evident, though indications of a weak eye were noted in microwave satellite imagery. Typhoon classification came from the well-developed banding features rather than any eye feature.

2) Damages reported in the Philippines included report of four casualties, On Hainan Island reports indicated significant crop destruction, loss of livestock and approximately 800 homes destroyed. Damages on Hainan were estimated at near 197 million U.S. dollars. Rains brought by the cyclone filled resevoirs and helped to relive the summer drought, reported as the worst since 1939.

|          |        |       |        | Stati | stic | s f | or J | TWC | on  | TY2 | :5W |     |      |         |     |     |         |         |         |     |
|----------|--------|-------|--------|-------|------|-----|------|-----|-----|-----|-----|-----|------|---------|-----|-----|---------|---------|---------|-----|
|          | 14/DAL | DEOT  |        |       | D0   | OIT | ION  |     | 000 |     |     |     | 14/1 | NID.    |     | 200 | 0       |         |         |     |
| DTO      |        | BEST  |        |       |      |     | ION  |     |     |     | 00  | 400 |      |         | ERF |     |         | 70      | 00      | 400 |
| DTG      | NO.    | LAT   | LONG   | wind  | 00   | 12  | 24   | 36  | 48  | 72  | 96  | 120 | 00   | 12      | 24  | 36  | 48      | 72      | 96      | 120 |
| 03111112 |        | 10.7N |        | 15    |      |     |      |     |     |     |     |     |      |         |     |     |         |         |         |     |
| 03111118 |        | 11.2N | 139.5E | 15    |      |     |      |     |     |     |     |     |      |         |     |     |         |         |         |     |
| 03111200 |        | 11.5N | 137.8E | 20    |      |     |      |     |     |     |     |     |      |         |     |     |         |         |         |     |
| 03111206 |        | 11.8N | 135.9E | 25    |      |     |      |     |     |     |     |     |      |         |     |     |         |         |         |     |
| 03111212 | 1      | 12.0N | 134.0E | 35    | 24   | 36  | 59   | 101 | 138 | 122 |     |     | -5   | 10      | -5  | 5   | 10      | 10      |         |     |
| 03111218 | 2      | 12.2N | 132.1E | 40    | 33   | 12  | 43   | 76  | 49  | 48  | 68  | 70  | 0    | 10      | 15  | 0   | 0       | 15      | 20      | 45  |
| 03111300 | 3      | 12.3N | 130.2E | 45    | 24   | 30  | 17   | 21  | 56  | 100 | 104 | 158 | 0    | 5       | 5   | -5  | 0       | 5       | 25      | 35  |
| 03111306 | 4      | 12.3N | 128.3E | 45    | 11   | 30  | 38   | 34  | 78  | 114 | 89  | 148 | 0    | 5       | 0   | 0   | 5       | 5       | 25      | 25  |
| 03111312 | 5      | 12.3N | 126.4E | 50    | 13   | 26  | 37   | 65  | 105 | 126 | 96  | 149 | 0    | 5       | 5   | 5   | 10      | 10      | 5       | 0   |
| 03111318 | 6      | 12.2N | 124.5E | 50    | 18   | 27  | 65   | 84  | 118 | 149 | 137 | 208 | 0    | 0       | 5   | 0   | 0       | -<br>30 | -<br>30 | -25 |
| 03111400 | 7      | 12.1N | 122.7E | 50    | 16   | 53  | 97   | 126 | 128 | 108 | 141 | 255 | 0    | -<br>10 | -5  | 5   | 0       | -<br>10 | -<br>45 | -25 |
| 03111406 | 8      | 12.1N | 121.1E | 55    | 18   | 73  | 134  | 149 | 130 | 129 | 220 | 360 | 0    | 5       | 5   | 5   | -<br>10 | -<br>10 | -<br>40 | -10 |
| 03111412 | 9      | 12.2N | 119.9E | 60    | 8    | 71  | 130  | 138 | 148 | 154 | 261 | 450 | 5    | 10      | 10  | 5   | -<br>10 | -<br>15 | -<br>25 | 0   |
| 03111418 | 10     | 12.4N | 118.9E | 60    | 16   | 75  | 118  | 121 | 154 | 166 | 240 |     | 0    | 0       | 5   | 0   | -<br>10 | -<br>15 | -<br>20 |     |
| 03111500 | 11     | 12.9N | 117.8E | 65    | 26   | 60  | 51   | 72  | 84  | 145 | 221 |     | 0    | 5       | 0   | -5  | -5      | 30      | -<br>15 |     |
| 03111506 | 12     | 13.5N | 116.8E | 65    | 0    | 21  | 51   | 71  | 99  | 133 | 155 |     | 0    | 5       | 0   | -5  | -5      | 30      | -5      |     |
| 03111512 | 13     | 13.9N | 115.9E | 65    | 0    | 48  | 54   | 66  | 110 | 183 | 227 |     | 0    | -5      | 0   | 0   | -<br>10 | -<br>25 | 0       |     |
| 03111518 | 14     | 14.1N | 114.9E | 65    | 23   | 54  | 68   | 104 | 135 | 207 |     |     | 0    | -5      | -5  | 0   | -<br>20 | -<br>20 |         |     |
| 03111600 | 15     | 14.3N | 113.9E | 75    | 37   | 48  | 74   | 129 | 165 | 240 |     |     | 0    | 5       | 5   | -5  | -<br>30 | -<br>20 |         |     |
| 03111606 | 16     | 14.7N | 112.9E | 75    | 0    | 17  | 29   | 17  | 26  | 33  |     |     | 0    | 5       | 10  | 0   | -<br>20 | 5       |         |     |

|          | ,  | ,     |         | ,  |    |    |     | ,   |     |     |     |     |    | ,       |         | ,       |         |         |    | ,  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|----|----|
| 03111612 | 17 | 15.2N | 112.0E  | 75 | 8  | 12 | 19  | 29  | 46  | 137 |     |     | 0  | 5       | 0       | -<br>20 | -<br>10 | 10      |    |    |
| 03111618 | 18 | 15.7N | 111.1E  | 75 | 0  | 13 | 42  | 63  | 103 |     |     |     | 0  | 5       | 0       | -<br>10 | 5       |         |    |    |
| 03111700 | 19 | 16.1N | 110.3E  | 70 | 16 | 47 | 81  | 112 | 173 |     |     |     | 0  | 0       | -<br>15 | 0       | -5      |         |    |    |
| 03111706 | 20 | 16.4N | 109.7E  | 65 | 0  | 26 | 50  | 86  | 132 |     |     |     | 0  | -<br>10 | -<br>20 | -5      | 5       |         |    |    |
| 03111712 | 21 | 16.9N | 109.3E  | 65 | 11 | 37 | 58  | 112 | 170 |     |     |     | 0  | -<br>15 | 0       | 0       | 15      |         |    |    |
| 03111718 | 22 | 17.5N | 109.0E  | 65 | 6  | 13 | 56  | 107 |     |     |     |     | 0  | -<br>10 | 5       | 15      |         |         |    |    |
| 03111800 | 23 | 18.1N | 108.8E  | 75 | 0  | 11 | 16  | 49  |     |     |     |     | 0  | 20      | 20      | 25      |         |         |    |    |
| 03111806 | 24 | 18.7N | 108.6E  | 70 | 5  | 6  | 38  |     |     |     |     |     | 0  | 10      | 20      |         |         |         |    |    |
| 03111812 | 25 | 19.2N | 108.5E  | 55 | 5  | 42 | 104 |     |     |     |     |     | 0  | 5       | 20      |         |         |         |    |    |
| 03111818 | 26 | 19.8N | 108.6E  | 50 | 12 | 48 |     |     |     |     |     |     | 0  | 10      |         |         |         |         |    |    |
| 03111900 | 27 | 20.4N | 108.9E  | 45 | 13 | 40 |     |     |     |     |     |     | 0  | 15      |         |         |         |         |    |    |
| 03111906 | 28 | 21.0N | 109.3E  | 30 | 16 |    |     |     |     |     |     |     | 0  |         |         |         |         |         |    |    |
| 03111912 | 29 | 21.7N | 109.7E  | 20 | 0  |    |     |     |     |     |     |     | 0  |         |         |         |         |         |    |    |
|          |    |       | AVERAGE |    | 13 | 36 | 61  | 84  | 112 | 135 | 163 | 225 | 0  | 7       | 7       | 5       | 9       | 16      | 21 | 21 |
|          |    |       | BIAS    |    |    |    |     |     |     |     |     |     | 0  | 2       | 3       | 0       | -5      | -<br>10 | -9 | 6  |
|          |    |       | # CASES |    | 29 | 27 | 25  | 23  | 21  | 17  | 12  | 8   | 29 | 27      | 25      | 23      | 21      | 17      | 12 | 8  |

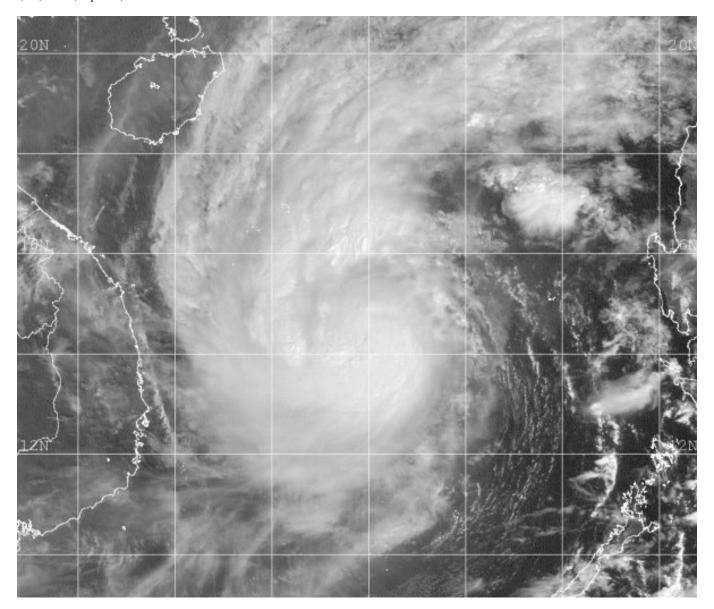


Figure 1-25W-1. 160125Z November 2003 GOES-9 visible satellite image of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.

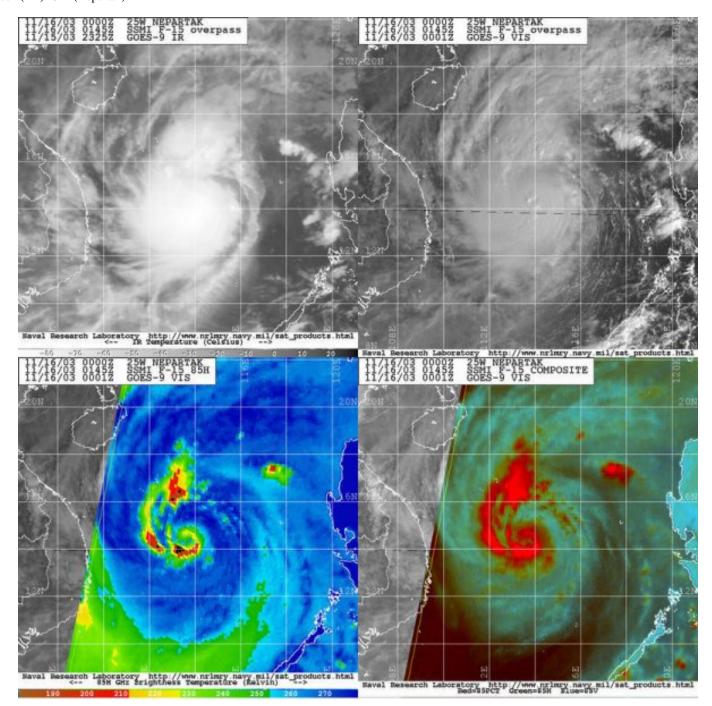


Figure 1-25W-2. 160145Z November 2003 multi-sensor satellite images of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.

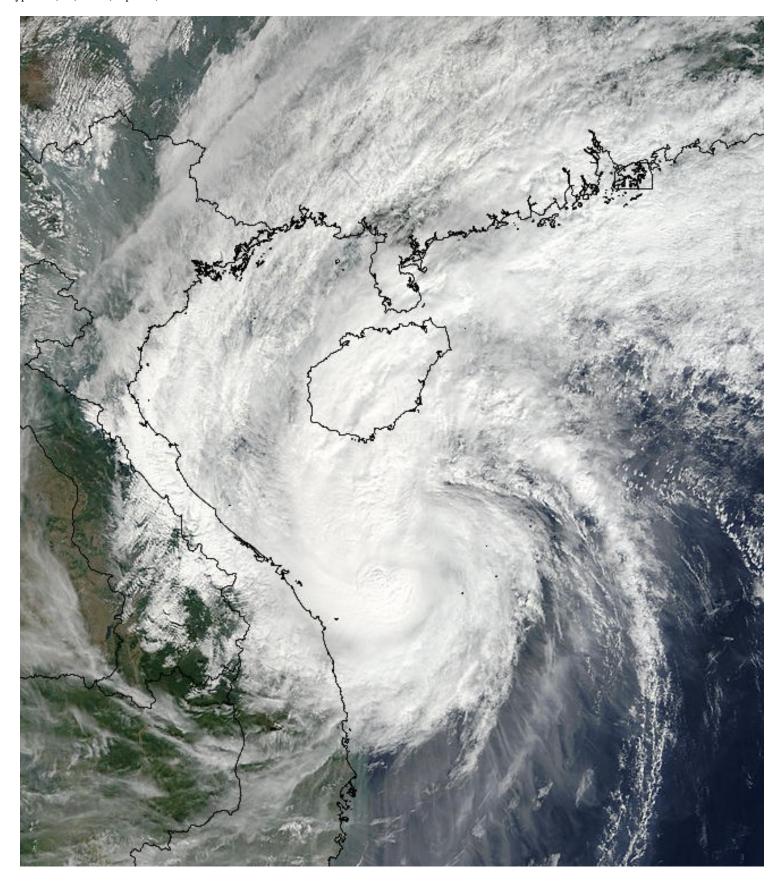
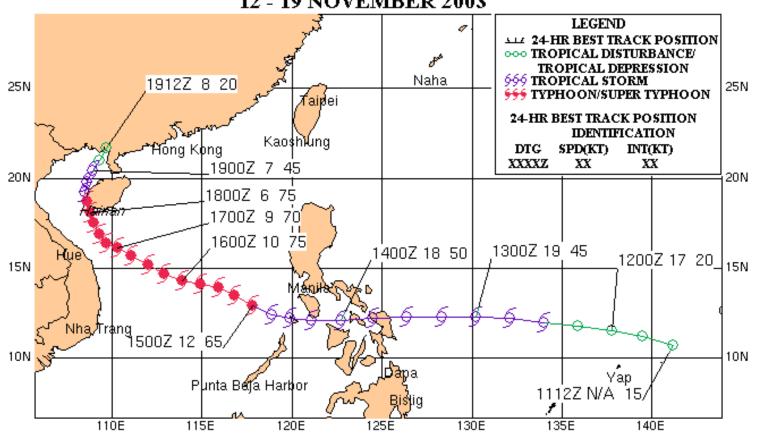
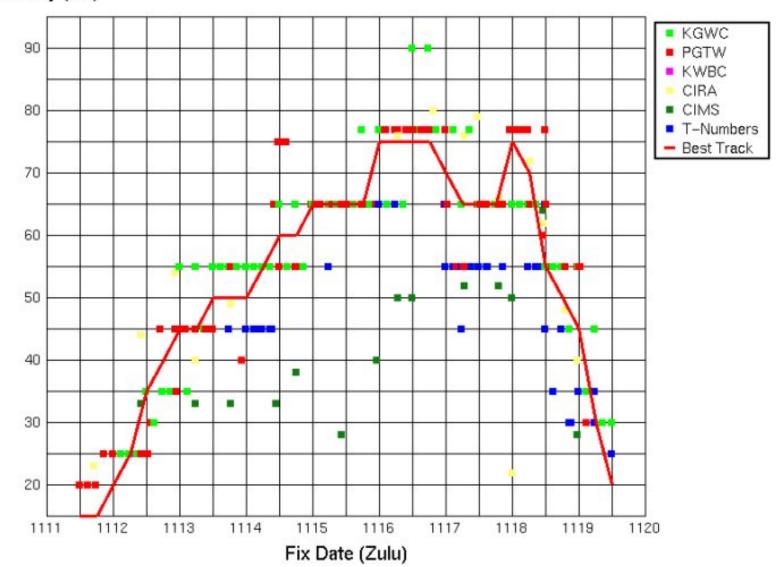


Figure 1-25W-3. 170320Z November 2003 MODIS true-color image of TY 25W (Nepartak), located off Vietnam, with an intensity of 65 knots.

#### TYPHOON 25W (NEPARTAK) 12 - 19 NOVEMBER 2003



# Time Intensity for 25W



## Typhoon (TY) 25W (Nepartak)\*



First Poor: 0000Z 11 Nov 03

First Fair: 1130Z 11 Nov 03

First TCFA: 2030Z 11 Nov 03

First Warning: 1200Z 12 Nov 03

Last Warning: 1200Z 19 Nov 03, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: Central Philippines, Hainan Island and Beihai, China

Total Warnings: 29

#### Remarks:

1) Typhoon (TY) 25W was first noted as an area of deep convection over broad surface troughing around 11 November northeast of Yap. After the cyclone developed and the first warning was issued, the cyclone began moving westward in response to the subtropical ridge situated to the north. As TY 08W tracked westward over the Philippines, land effects resulted in a brief period of weakening, however re-intensification occurred over open water in the South China Sea.

By 0600Z on 16 November, TY 25W began tracking more poleward, along the western periphery of the steering ridge, subsequently making landfall a second time along the southwest coast of Hainan Island. A third and final landfall occurred on the south coast of China at around 1100Z on 19 November. The cyclone dissipated rapidly and a final warning was issued by 1200Z on 19 November.

While TY 25W attained a maximum intensity of 75 knots, no well-formed eye was ever evident, though indications of a weak eye were noted in microwave satellite imagery. Typhoon classification came from the well-developed banding features rather than any eye feature.

2) Damages reported in the Philippines included report of four casualties, On Hainan Island reports indicated significant crop destruction, loss of livestock and approximately 800 homes destroyed. Damages on Hainan were estimated at near 197 million U.S. dollars. Rains brought by the cyclone filled resevoirs and helped to relive the summer drought, reported as the worst since 1939.

#### Statistics for JTWC on TY25W

|          | WRN | BEST  | TRACK  |      | PC | SIT | ION | ERR | ORS |     |     |     | WI | ND      | ERF     | ROR     | S       |         |         |     |
|----------|-----|-------|--------|------|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT   | LONG   | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96  | 120 | 00 | 12      | 24      | 36      | 48      | 72      | 96      | 120 |
| 03111112 |     | 10.7N | 141.2E | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03111118 |     | 11.2N | 139.5E | 15   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03111200 |     | 11.5N | 137.8E | 20   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03111206 |     | 11.8N | 135.9E | 25   |    |     |     |     |     |     |     |     |    |         |         |         |         |         |         |     |
| 03111212 | 1   | 12.0N | 134.0E | 35   | 24 | 36  | 59  | 101 | 138 | 122 |     |     | -5 | -<br>10 | -5      | 5       | -<br>10 | -<br>10 |         |     |
| 03111218 | 2   | 12.2N | 132.1E | 40   | 33 | 12  | 43  | 76  | 49  | 48  | 68  | 70  | 0  | 10      | 15      | 0       | 0       | 15      | 20      | 45  |
| 03111300 | 3   | 12.3N | 130.2E | 45   | 24 | 30  | 17  | 21  | 56  | 100 | 104 | 158 | 0  | 5       | 5       | -5      | 0       | 5       | 25      | 35  |
| 03111306 | 4   | 12.3N | 128.3E | 45   | 11 | 30  | 38  | 34  | 78  | 114 | 89  | 148 | 0  | 5       | 0       | 0       | 5       | 5       | 25      | 25  |
| 03111312 | 5   | 12.3N | 126.4E | 50   | 13 | 26  | 37  | 65  | 105 | 126 | 96  | 149 | 0  | 5       | 5       | 5       | 10      | 10      | 5       | 0   |
| 03111318 | 6   | 12.2N | 124.5E | 50   | 18 | 27  | 65  | 84  | 118 | 149 | 137 | 208 | 0  | 0       | 5       | 0       | 0       | -<br>30 | -<br>30 | -25 |
| 03111400 | 7   | 12.1N | 122.7E | 50   | 16 | 53  | 97  | 126 | 128 | 108 | 141 | 255 | 0  | -<br>10 | -5      | 5       | 0       | -<br>10 | -<br>45 | -25 |
| 03111406 | 8   | 12.1N | 121.1E | 55   | 18 | 73  | 134 | 149 | 130 | 129 | 220 | 360 | 0  | 5       | 5       | 5       | -<br>10 | -<br>10 | -<br>40 | -10 |
| 03111412 | 9   | 12.2N | 119.9E | 60   | 8  | 71  | 130 | 138 | 148 | 154 | 261 | 450 | 5  | 10      | 10      | 5       | -<br>10 | -<br>15 | -<br>25 | 0   |
| 03111418 | 10  | 12.4N | 118.9E | 60   | 16 | 75  | 118 | 121 | 154 | 166 | 240 |     | 0  | 0       | 5       | 0       | -<br>10 | -<br>15 | -<br>20 |     |
| 03111500 | 11  | 12.9N | 117.8E | 65   | 26 | 60  | 51  | 72  | 84  | 145 | 221 |     | 0  | 5       | 0       | -5      | -5      | -<br>30 | -<br>15 |     |
| 03111506 | 12  | 13.5N | 116.8E | 65   | 0  | 21  | 51  | 71  | 99  | 133 | 155 |     | 0  | 5       | 0       | -5      | -5      | -<br>30 | -5      |     |
| 03111512 | 13  | 13.9N | 115.9E | 65   | 0  | 48  | 54  | 66  | 110 | 183 | 227 |     | 0  | -5      | 0       | 0       | -<br>10 | -<br>25 | 0       |     |
| 03111518 | 14  | 14.1N | 114.9E | 65   | 23 | 54  | 68  | 104 | 135 | 207 |     |     | 0  | -5      | -5      | 0       | -<br>20 | -<br>20 |         |     |
| 03111600 | 15  | 14.3N | 113.9E | 75   | 37 | 48  | 74  | 129 | 165 | 240 |     |     | 0  | 5       | 5       | -5      | -<br>30 | -<br>20 |         |     |
| 03111606 | 16  | 14.7N | 112.9E | 75   | 0  | 17  | 29  | 17  | 26  | 33  |     |     | 0  | 5       | 10      | 0       | -<br>20 | 5       |         |     |
| 03111612 | 17  | 15.2N | 112.0E | 75   | 8  | 12  | 19  | 29  | 46  | 137 |     |     | 0  | 5       | 0       | -<br>20 | -<br>10 | 10      |         |     |
| 03111618 | 18  | 15.7N | 111.1E | 75   | 0  | 13  | 42  | 63  | 103 |     |     |     | 0  | 5       | 0       | -<br>10 | 5       |         |         |     |
| 03111700 | 19  | 16.1N | 110.3E | 70   | 16 | 47  | 81  | 112 | 173 |     |     |     | 0  | 0       | -<br>15 | 0       | -5      |         |         |     |

| 03111706 | 20 | 16.4N | 109.7E  | 65 | 0  | 26 | 50  | 86  | 132 |     |     |     | 0  | -<br>10 | -<br>20 | -5 | 5  |         |    |    |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|----|----|---------|----|----|
| 03111712 | 21 | 16.9N | 109.3E  | 65 | 11 | 37 | 58  | 112 | 170 |     |     |     | 0  | -<br>15 | 0       | 0  | 15 |         |    |    |
| 03111718 | 22 | 17.5N | 109.0E  | 65 | 6  | 13 | 56  | 107 |     |     |     |     | 0  | -<br>10 | 5       | 15 |    |         |    |    |
| 03111800 | 23 | 18.1N | 108.8E  | 75 | 0  | 11 | 16  | 49  |     |     |     |     | 0  | 20      | 20      | 25 |    |         |    |    |
| 03111806 | 24 | 18.7N | 108.6E  | 70 | 5  | 6  | 38  |     |     |     |     |     | 0  | 10      | 20      |    |    |         |    |    |
| 03111812 | 25 | 19.2N | 108.5E  | 55 | 5  | 42 | 104 |     |     |     |     |     | 0  | 5       | 20      |    |    |         |    |    |
| 03111818 | 26 | 19.8N | 108.6E  | 50 | 12 | 48 |     |     |     |     |     |     | 0  | 10      |         |    |    |         |    |    |
| 03111900 | 27 | 20.4N | 108.9E  | 45 | 13 | 40 |     |     |     |     |     |     | 0  | 15      |         |    |    |         |    |    |
| 03111906 | 28 | 21.0N | 109.3E  | 30 | 16 |    |     |     |     |     |     |     | 0  |         |         |    |    |         |    |    |
| 03111912 | 29 | 21.7N | 109.7E  | 20 | 0  |    |     |     |     |     |     |     | 0  |         |         |    |    |         |    |    |
|          |    |       | AVERAGE |    | 13 | 36 | 61  | 84  | 112 | 135 | 163 | 225 | 0  | 7       | 7       | 5  | 9  | 16      | 21 | 21 |
|          |    |       | BIAS    |    |    |    |     |     |     |     |     |     | 0  | 2       | 3       | 0  | -5 | -<br>10 | -9 | 6  |
|          |    |       | # CASES |    | 29 | 27 | 25  | 23  | 21  | 17  | 12  | 8   | 29 | 27      | 25      | 23 | 21 | 17      | 12 | 8  |

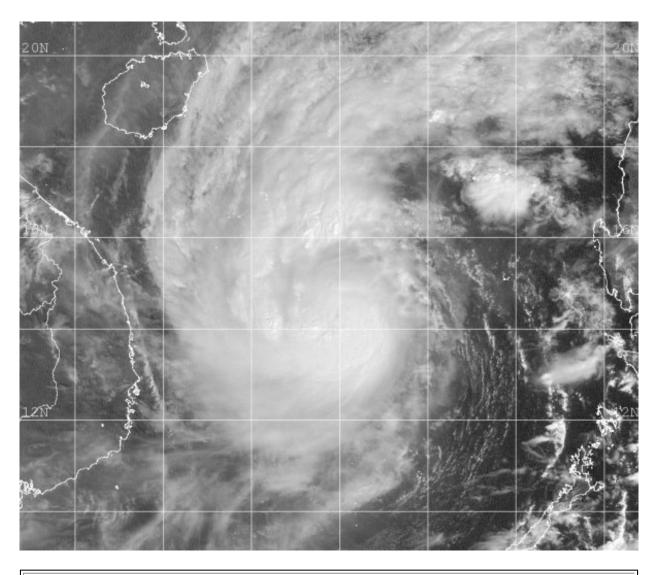


Figure 1-25W-1. 160125Z November 2003 GOES-9 visible satellite image of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.

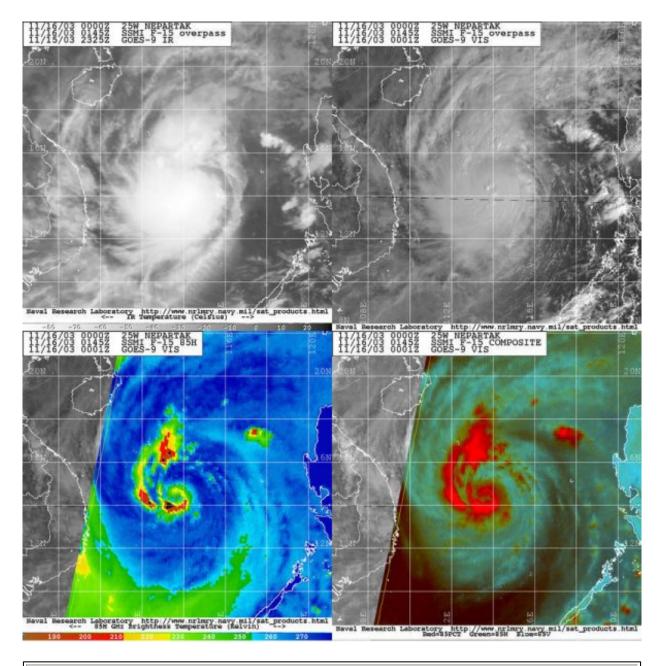


Figure 1-25W-2. 160145Z November 2003 multi-sensor satellite images of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.

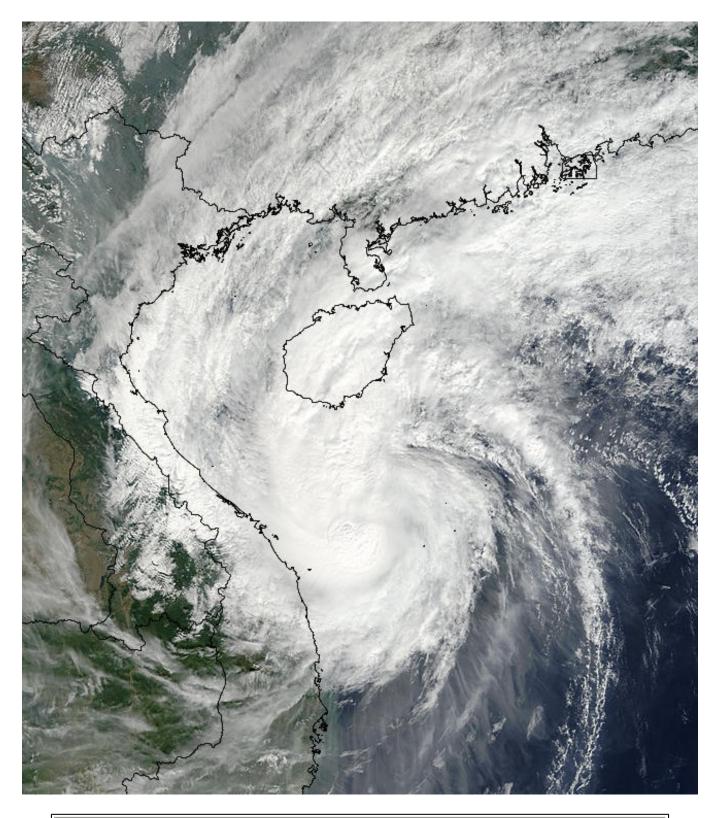
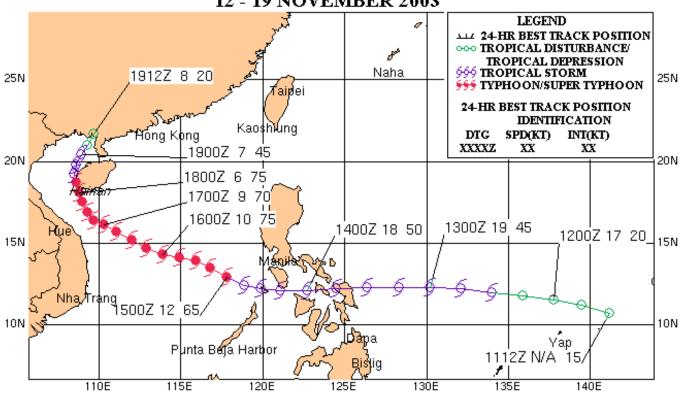
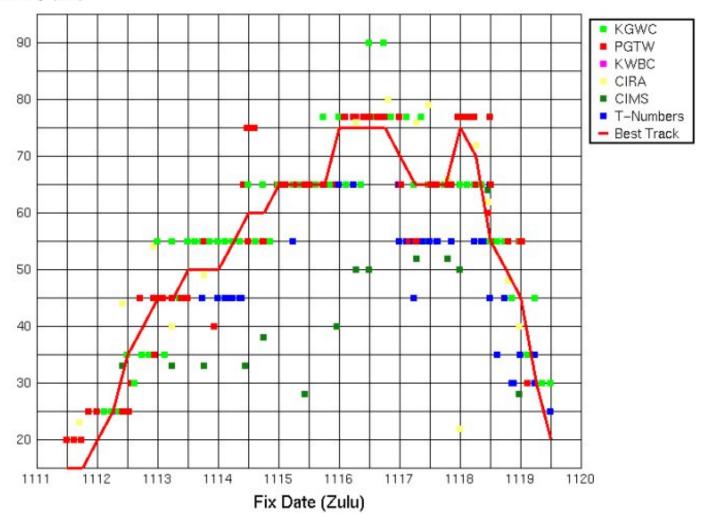


Figure 1-25W-3. 170320Z November 2003 MODIS true-color image of TY 25W (Nepartak), located off Vietnam, with an intensity of 65 knots.

#### TYPHOON 25W (NEPARTAK) 12 - 19 NOVEMBER 2003



# Time Intensity for 25W



## Super Typhoon (STY) 26W (Lupit)\*



First Poor: 0900Z 15 Nov 03

First Fair: 2100Z 17 Nov 03

First TCFA: 0230Z 17 Nov 03

First Warning: 1800Z 20 Nov 03

Last Warning: 0600Z 01 Dec 03, Extratropical

Max Intensity: 145 kts, gusts to 175 kts

Landfall: N/A

Total Warnings: 47

#### Remarks:

1) Super typhoon (STY) 26W developed in the monsoon trough around 14 November, approximately 360 nautical miles northeast of Kwajalein atoll; first warning was issued at 1800Z on 19 November. The cyclone remained below tropical storm strength for 24 hours while moving southwestward along the southeastern periphery of a mid-level steering ridge centered to the north-northwest. STY 26W subsequently tracked westward along the southern periphery of the subtropical ridge over the next three days passing within 90 nautical miles of Chuuk at approximately 0800Z on 22 November.

The cyclone intensified steadily after 20 November and attained super typhoon intensity at 0000Z on 26 November. STY 26W began to move more northwestward early on 24 November, along the southwestern quadrant of the mid-level steering ridge, and achieved maximum intensity of 145 knots at 1200Z on 27 November in the Philippine Sea.

STY 26W begand tracking poleward toward a weakness in the subtropical ridge produced by a midlatitude trough in the westerlies. The cyclone began to weaken as it approached the ridge axis in response to increased vertical wind shear. After STY 26W crested the ridge axis at around 0600Z on 29 November, it continued to weaken as it encountered cooler sea surface temperatures, drier air, and increased vertical wind shear associated with a mid-latitude baroclinic zone. The cyclone started to undergo extratropical transition, while accelerating northeastward, and completed extratropical transition around 0600Z on 01 December, approximately 340 nautical miles south of Tokyo, Japan.

2) No casualties were reported for this cyclone, but severe damage was reported to trees and crops on Yap and Ulithi atoll.

|          |      |        | ;      | Statis | tic | s fo | r <b>JT</b> \ | NC ( | on S | TY2 | 6W  |     |      |    |     |     |         |         |         |     |
|----------|------|--------|--------|--------|-----|------|---------------|------|------|-----|-----|-----|------|----|-----|-----|---------|---------|---------|-----|
|          | WRN  | BEST T | TRACK  |        | PC  | ITIP | ON E          | RR(  | )RS  |     |     |     | \\/\ | ND | FRI | ROF | 25      |         |         |     |
| DTG      | NO.  | LAT    | LONG   | wind   |     |      | 24            | 36   | 48   | 72  | 96  | 120 |      |    |     | 36  |         | 72      | 96      | 120 |
| 03111412 | 140. | 12.8N  |        | 20     | 00  | ' _  |               |      | 70   |     | 30  | 120 | 00   | 12 |     | 00  | 70      | 1 2     | 00      | 120 |
| 03111418 |      | 13.3N  | 171.9E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111500 |      | 13.7N  | 171.5E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111506 |      | 14.0N  | 171.1E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111512 |      |        | 170.6E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111518 |      | 14.2N  | 170.0E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111600 |      | 14.2N  | 169.2E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111606 |      | 14.2N  | 168.4E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111612 |      | 13.9N  | 167.6E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111618 |      | 13.3N  | 167.2E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111700 |      | 12.7N  | 167.0E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111706 |      | 12.1N  | 166.9E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111712 |      | 11.5N  | 166.8E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111718 |      | 11.0N  | 166.4E | 15     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111800 |      | 10.9N  | 165.7E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111806 |      | 10.9N  | 165.1E | 20     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111812 |      | 10.9N  | 164.4E | 25     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111818 |      | 10.9N  | 163.7E | 25     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111900 |      | 10.6N  | 163.1E | 25     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111906 |      | 10.0N  | 162.7E | 25     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111912 |      | 9.5N   | 162.3E | 25     |     |      |               |      |      |     |     |     |      |    |     |     |         |         |         |     |
| 03111918 | 1    | 9.1N   | 162.0E | 25     | 18  | 65   | 130           | 142  | 122  | 80  | 178 | 193 | 0    | 0  | 0   | 10  | 10      | 0       | 0       | 0   |
| 03112000 | 2    | 9.0N   | 161.6E | 25     | 8   | 36   | 91            | 71   | 43   | 110 | 145 | 65  | 0    | 0  | 0   | 5   | -5      | -5      | 0       | 0   |
| 03112006 | 3    | 8.9N   | 161.2E | 30     | 8   | 21   | 40            | 56   | 88   | 156 | 92  | 107 | -5   | -5 | 0   | 0   | -<br>10 | -<br>15 | -<br>10 | -15 |
| 03112012 | 4    | 8.9N   | 160.8E | 30     | 5   | 24   | 24            | 62   | 85   | 166 | 160 | 148 | 0    | 5  | 5   | -5  | -5      | -<br>10 | -5      | -5  |

| 03112018 | 5  | 8.9N  | 160.2E | 35  | 5  | 12  | 72  | 117 | 154 | 201 | 114 | 110 | 0  | 5       | 10      | -5      | 0       | 10      | 20      | 20  |
|----------|----|-------|--------|-----|----|-----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03112100 | 6  | 9.0N  | 159.4E | 35  | 36 | 113 | 163 | 213 | 250 | 228 | 127 | 115 | 0  | 5       | -5      | -5      | -5      | 10      | 20      | 15  |
| 03112106 | 7  | 9.1N  | 158.2E | 35  | 17 | 74  | 133 | 175 | 211 | 155 | 116 | 96  | 0  | -5      | -<br>15 | -<br>15 | -<br>10 | 10      | 10      | 5   |
| 03112112 | 8  | 9.0N  | 156.8E | 40  | 16 | 54  | 85  | 128 | 153 | 156 | 144 | 316 | -5 | -<br>20 | -<br>20 | -<br>15 | -<br>10 | 5       | 10      | 5   |
| 03112118 | 9  | 8.8N  | 155.4E | 45  | 5  | 42  | 60  | 88  | 102 | 131 | 176 | 272 | 0  | -5      | 0       | 0       | 5       | 10      | 5       | -15 |
| 03112200 | 10 | 8.8N  | 153.9E | 60  | 13 | 13  | 32  | 68  | 97  | 95  | 97  | 149 | 0  | 5       | 15      | 15      | 20      | 15      | -5      | -10 |
| 03112206 | 11 | 8.8N  | 152.3E | 65  | 5  | 30  | 84  | 112 | 136 | 77  | 106 | 109 | 0  | 5       | 10      | 10      | 20      | 5       | -<br>15 | -10 |
| 03112212 | 12 | 8.8N  | 150.7E | 70  | 13 | 63  | 121 | 175 | 202 | 130 | 169 | 134 | 0  | 0       | 0       | 5       | 10      | 5       | -<br>15 | -15 |
| 03112218 | 13 | 8.8N  | 149.1E | 75  | 8  | 75  | 118 | 181 | 198 | 166 | 216 | 186 | 0  | 0       | 0       | 10      | 10      | 0       | -<br>15 | -5  |
| 03112300 | 14 | 8.2N  | 147.8E | 80  | 18 | 75  | 139 | 187 | 171 | 152 | 169 | 139 | 0  | 0       | 5       | 10      | 10      | -5      | -<br>10 | -5  |
| 03112306 | 15 | 7.9N  | 146.6E | 85  | 0  | 13  | 79  | 89  | 64  | 74  | 55  | 58  | 5  | 5       | 15      | 15      | 10      | -<br>10 | -5      | -5  |
| 03112312 | 16 | 7.8N  | 145.5E | 90  | 0  | 19  | 54  | 51  | 54  | 60  | 35  | 42  | 5  | 10      | 15      | 15      | 10      | -<br>10 | -<br>10 | -10 |
| 03112318 | 17 | 7.8N  | 144.5E | 95  | 18 | 77  | 55  | 30  | 36  | 50  | 75  | 93  | 0  | 15      | 10      | 5       | 10      | -<br>15 | -<br>15 | -10 |
| 03112400 | 18 | 8.1N  | 143.8E | 95  | 25 | 55  | 61  | 76  | 71  | 87  | 122 | 147 | 0  | 5       | 10      | 5       | 0       | -<br>15 | -<br>25 | -10 |
| 03112406 | 19 | 8.5N  | 143.1E | 95  | 18 | 49  | 88  | 113 | 107 | 134 | 163 | 179 | 0  | 0       | -5      | 0       | -<br>15 | -<br>25 | -<br>30 | -5  |
| 03112412 | 20 | 9.1N  | 142.2E | 100 | 0  | 48  | 95  | 82  | 64  | 122 | 138 | 120 | -5 | 0       | -5      | -<br>10 | -<br>20 | -<br>35 | -<br>30 | -5  |
| 03112418 | 21 | 9.9N  | 141.1E | 105 | 8  | 36  | 46  | 30  | 25  | 52  | 58  | 136 | -5 | 5       | 10      | 0       | 5       | 10      | 20      | 40  |
| 03112500 | 22 | 10.7N | 139.9E | 105 | 13 | 24  | 19  | 30  | 13  | 38  | 120 | 273 | 0  | 5       | 0       | -5      | 0       | 5       | 25      | 35  |
| 03112506 | 23 | 11.4N | 138.7E | 115 | 13 | 21  | 29  | 26  | 13  | 42  | 108 | 324 | 0  | 5       | -5      | 0       | 0       | 0       | 20      | 15  |
| 03112512 | 24 | 12.0N | 137.7E | 115 | 16 | 35  | 45  | 46  | 39  | 46  | 133 | 404 | 0  | -5      | -<br>10 | -5      | -<br>10 | -<br>10 | 10      | 10  |
| 03112518 | 25 | 12.2N | 137.1E | 120 | 0  | 30  | 46  | 42  | 40  | 78  | 177 | 403 | 0  | -<br>10 | 0       | 5       | 10      | 15      | 30      | 25  |
| 03112600 | 26 | 12.6N | 136.7E | 130 | 12 | 46  | 35  | 48  | 45  | 120 | 177 | 364 | 0  | 5       | 10      | 10      | 20      | 35      | 40      | 35  |
| 03112606 | 27 | 13.1N | 136.3E | 140 | 13 | 19  | 21  | 30  | 18  | 97  | 188 | 358 | 0  | 5       | 10      | 20      | 15      | 40      | 35      | 30  |
| 03112612 | 28 | 13.6N | 136.0E | 140 | 13 | 8   | 6   | 25  | 24  | 59  | 183 | 348 | 5  | 10      | 10      | 15      | 10      | 30      | 30      | 20  |
| 03112618 | 29 | 13.8N | 135.4E | 140 | 5  | 25  | 38  | 34  | 60  | 21  | 130 | 207 | 0  | 5       | 15      | 10      | 5       | 20      | 20      | 20  |
| 03112700 | 30 | 14.1N | 134.9E | 140 | 0  | 12  | 33  | 41  | 74  | 51  | 152 | 204 | 5  | 0       | 15      | 15      | 15      | 15      | 25      | 20  |
| 03112706 | 31 | 14.5N | 134.3E | 140 | 5  | 23  | 29  | 53  | 81  | 78  | 156 | 291 | 5  | 15      | 10      | 10      | 20      | 15      | 15      | 15  |
| 03112712 | 32 | 15.0N | 133.8E | 145 | 0  | 24  | 8   | 40  | 45  | 110 | 132 |     | 0  | 10      | 0       | 15      | 15      | 10      | 5       |     |

| 03112718 | 33 | 15.3N | 133.2E  | 135 | 0  | 6  | 26  | 58  | 25  | 130 | 150 |     | 5       | 5       | 5       | 15      | 10      | 10      | 0  |    |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|----|----|
| 03112800 | 34 | 15.6N | 132.8E  | 135 | 8  | 35 | 66  | 75  | 73  | 181 | 193 |     | 5       | 0       | 10      | 10      | 0       | 15      | 5  |    |
| 03112806 | 35 | 16.4N | 132.3E  | 135 | 11 | 21 | 47  | 21  | 33  | 84  | 158 |     | 5       | 10      | 10      | 0       | -<br>15 | 5       | 5  |    |
| 03112812 | 36 | 17.1N | 131.9E  | 135 | 12 | 29 | 40  | 13  | 23  | 77  |     |     | 5       | 10      | 0       | -<br>15 | -<br>20 | 0       |    |    |
| 03112818 | 37 | 17.7N | 131.3E  | 125 | 0  | 26 | 18  | 48  | 81  | 101 |     |     | 0       | 5       | -<br>10 | -<br>25 | -<br>20 | -<br>15 |    |    |
| 03112900 | 38 | 18.4N | 130.8E  | 115 | 11 | 21 | 89  | 188 | 234 | 175 |     |     | 0       | -<br>10 | -<br>20 | -<br>30 | -<br>20 | -<br>15 |    |    |
| 03112906 | 39 | 19.2N | 130.5E  | 105 | 5  | 34 | 68  | 117 | 84  | 113 |     |     | 0       | -<br>10 | -<br>25 | -<br>15 | -<br>15 | -<br>10 |    |    |
| 03112912 | 40 | 20.1N | 130.9E  | 105 | 13 | 49 | 75  | 101 | 72  |     |     |     | -5      | -<br>15 | -<br>25 | -<br>10 | -<br>10 |         |    |    |
| 03112918 | 41 | 21.1N | 131.7E  | 100 | 21 | 28 | 66  | 73  | 36  |     |     |     | -5      | -<br>15 | -<br>10 | -<br>10 | -<br>15 |         |    |    |
| 03113000 | 42 | 22.1N | 132.6E  | 100 | 26 | 49 | 80  | 82  | 66  |     |     |     | -<br>10 | -<br>20 | -5      | -<br>10 | -<br>10 |         |    |    |
| 03113006 | 43 | 23.3N | 134.0E  | 100 | 28 | 76 | 73  | 35  | 69  |     |     |     | -<br>10 | -5      | 0       | -5      | -5      |         |    |    |
| 03113012 | 44 | 24.6N | 135.4E  | 95  | 13 | 37 | 36  | 24  |     |     |     |     | -<br>10 | 0       | 0       | -5      |         |         |    |    |
| 03113018 | 45 | 25.8N | 137.5E  | 80  | 16 | 89 | 138 | 250 |     |     |     |     | -<br>10 | -<br>10 | -<br>15 | -<br>10 |         |         |    |    |
| 03120100 | 46 | 27.7N | 138.8E  | 70  | 36 | 68 | 117 |     |     |     |     |     | -<br>10 | -<br>15 | -<br>15 |         |         |         |    |    |
| 03120106 | 47 | 29.6N | 140.0E  | 65  | 31 | 57 | 90  |     |     |     |     |     | -5      | -<br>10 | -<br>10 |         |         |         |    |    |
| 03120112 |    | 30.9N | 142.0E  | 60  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120118 |    | 32.2N | 144.3E  | 60  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120200 |    | 34.0N | 146.3E  | 55  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120206 |    | 35.7N | 148.6E  | 50  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
|          |    |       | AVERAGE |     | 12 | 40 | 66  | 83  | 86  | 107 | 138 | 196 | 3       | 7       | 9       | 10      | 11      | 13      | 15 | 14 |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | -1      | 0       | 0       | 1       | 0       | 3       | 5  | 6  |
|          |    |       | # CASES |     | 47 | 47 | 47  | 45  | 43  | 39  | 35  | 31  | 47      | 47      | 47      | 45      | 43      | 39      | 35 | 31 |

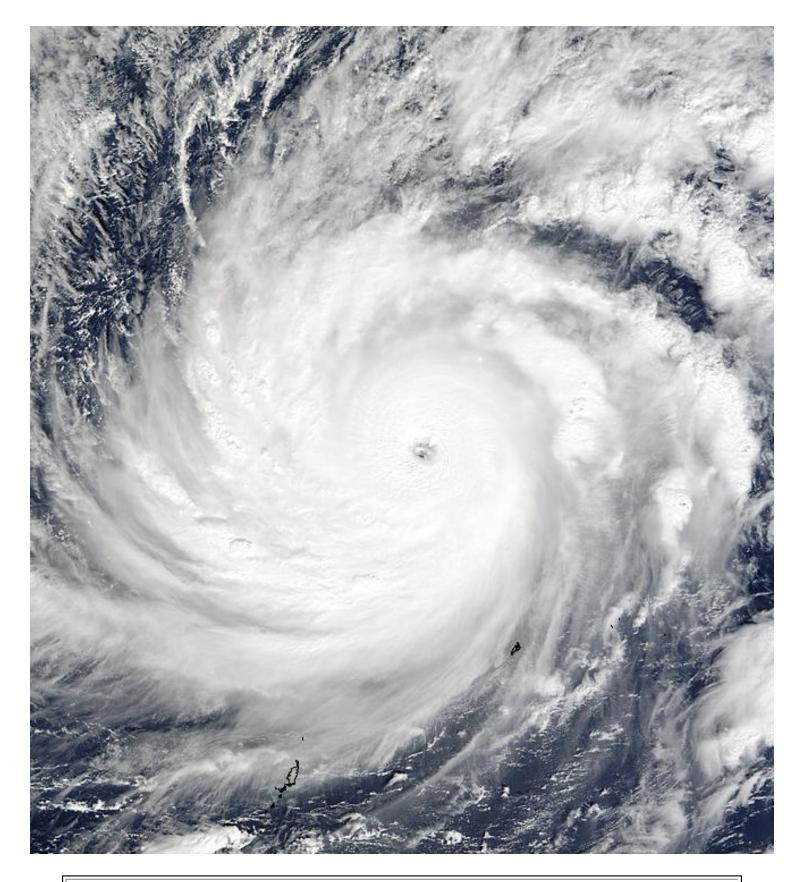


Figure 1-26W-1. 260135Z November 2003 MODIS true color image of 26W (Lupit), north of Yap, with an intensity of 130 knots.

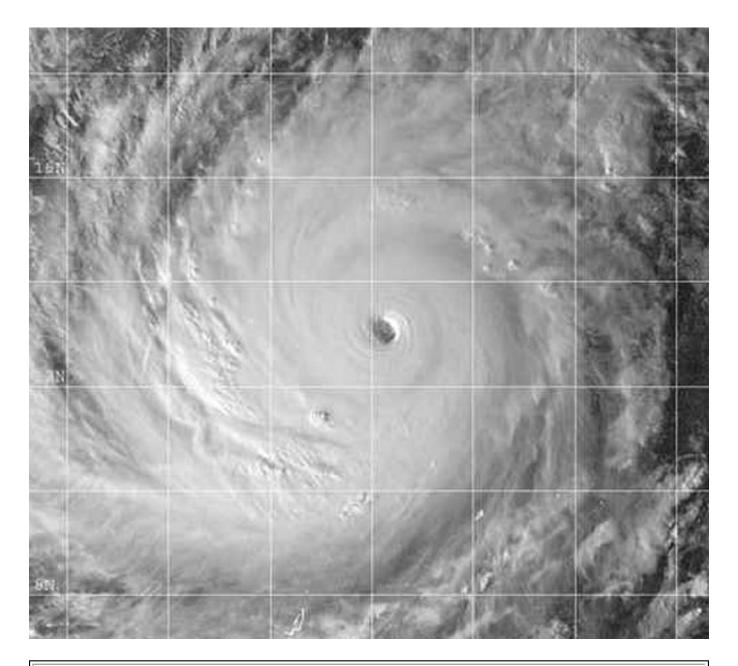


Figure 1-26W-2. 260702Z November 2003 GOES-9 visible satellite image of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

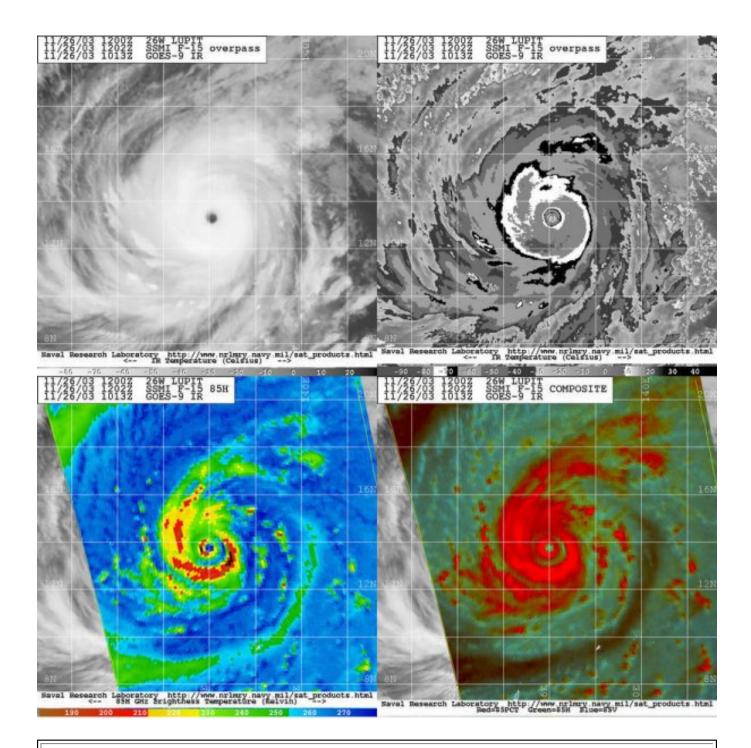
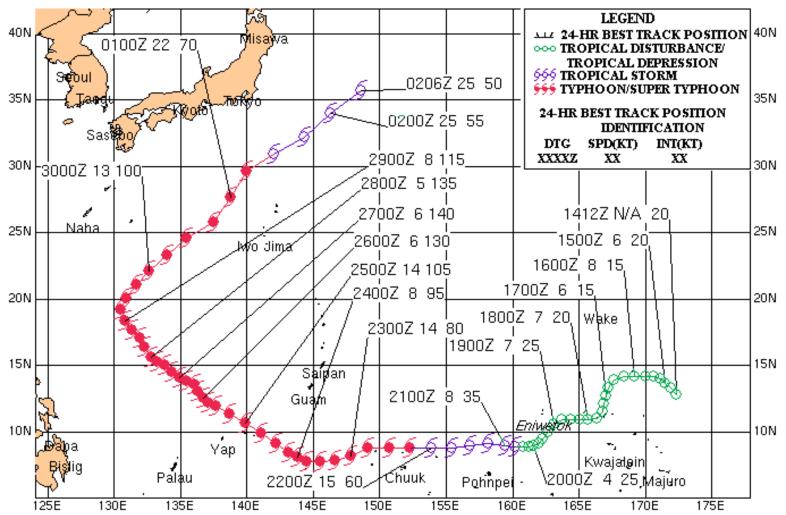
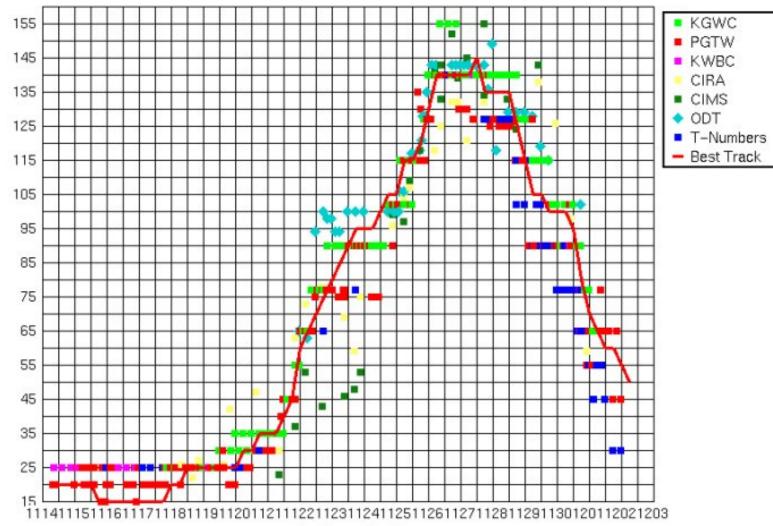


Figure 1-26W-3. 261202Z November 2003 multi-sensor satellite images of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

### SUPER TYPHOON 26W (LUPIT) 20 NOVEMBER - 01 DECEMBER 2003



# Time Intensity for 26W



Fix Date (Zulu)

## Super Typhoon (STY) 26W (Lupit)\*



First Poor : 0900Z 15 Nov 03

First Fair: 2100Z 17 Nov 03

First TCFA: 0230Z 17 Nov 03

First Warning: 1800Z 20 Nov 03

Last Warning: 0600Z 01 Dec 03, Extratropical

Max Intensity: 145 kts, gusts to 175 kts

Landfall: N/A

Total Warnings: 47

#### Remarks:

1) Super typhoon (STY) 26W developed in the monsoon trough around 14 November, approximately 360 nautical miles northeast of Kwajalein atoll; first warning was issued at 1800Z on 19 November. The cyclone remained below tropical storm strength for 24 hours while moving southwestward along the southeastern periphery of a mid-level steering ridge centered to the north-northwest. STY 26W subsequently tracked westward along the southern periphery of the subtropical ridge over the next three days passing within 90 nautical miles of Chuuk at approximately 0800Z on 22 November.

The cyclone intensified steadily after 20 November and attained super typhoon intensity at 0000Z on 26 November. STY 26W began to move more northwestward early on 24 November, along the southwestern quadrant of the mid-level steering ridge, and achieved maximum intensity of 145 knots at 1200Z on 27 November in the Philippine Sea.

STY 26W begand tracking poleward toward a weakness in the subtropical ridge produced by a midlatitude trough in the westerlies. The cyclone began to weaken as it approached the ridge axis in response to increased vertical wind shear. After STY 26W crested the ridge axis at around 0600Z on 29 November, it continued to weaken as it encountered cooler sea surface temperatures, drier air, and increased vertical wind shear associated with a mid-latitude baroclinic zone. The cyclone started to undergo extratropical transition, while accelerating northeastward, and completed extratropical transition around 0600Z on 01 December, approximately 340 nautical miles south of Tokyo, Japan.

2) No casualties were reported for this cyclone, but severe damage was reported to trees and crops on Yap and Ulithi atoll.

\*Named by WMO Designated RSMC

### Statistics for JTWC on STY26W

|          | WRN | BEST  | TRACK  |      | PO | SITI | ON E | RRC | DRS |     |     |     | WII | ND | ERF     | ROF     | RS      |         |         |     |
|----------|-----|-------|--------|------|----|------|------|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|-----|
| DTG      | NO. | LAT   | LONG   | wind | 00 | 12   | 24   | 36  | 48  | 72  | 96  | 120 | 00  | 12 | 24      | 36      | 48      | 72      | 96      | 120 |
| 03111412 |     | 12.8N | 172.3E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111418 |     | 13.3N | 171.9E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111500 |     | 13.7N | 171.5E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111506 |     | 14.0N | 171.1E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111512 |     | 14.2N | 170.6E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111518 |     | 14.2N | 170.0E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111600 |     | 14.2N | 169.2E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111606 |     | 14.2N | 168.4E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111612 |     | 13.9N | 167.6E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111618 |     | 13.3N | 167.2E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111700 |     | 12.7N | 167.0E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111706 |     | 12.1N | 166.9E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111712 |     | 11.5N | 166.8E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111718 |     | 11.0N | 166.4E | 15   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111800 |     | 10.9N | 165.7E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111806 |     | 10.9N | 165.1E | 20   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111812 |     | 10.9N | 164.4E | 25   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111818 |     | 10.9N | 163.7E | 25   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111900 |     | 10.6N | 163.1E | 25   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111906 |     | 10.0N | 162.7E | 25   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111912 |     | 9.5N  | 162.3E | 25   |    |      |      |     |     |     |     |     |     |    |         |         |         |         |         |     |
| 03111918 | 1   | 9.1N  | 162.0E | 25   | 18 | 65   | 130  | 142 | 122 | 80  | 178 | 193 | 0   | 0  | 0       | 10      | 10      | 0       | 0       | 0   |
| 03112000 | 2   | 9.0N  | 161.6E | 25   | 8  | 36   | 91   | 71  | 43  | 110 | 145 | 65  | 0   | 0  | 0       | 5       | -5      | -5      | 0       | 0   |
| 03112006 | 3   | 8.9N  | 161.2E | 30   | 8  | 21   | 40   | 56  | 88  | 156 | 92  | 107 | -5  | -5 | 0       | 0       | -<br>10 | -<br>15 | -<br>10 | -15 |
| 03112012 | 4   | 8.9N  | 160.8E | 30   | 5  | 24   | 24   | 62  | 85  | 166 | 160 | 148 | 0   | 5  | 5       | -5      | -5      | -<br>10 | -5      | -5  |
| 03112018 | 5   | 8.9N  | 160.2E | 35   | 5  | 12   | 72   | 117 | 154 | 201 | 114 | 110 | 0   | 5  | 10      | -5      | 0       | 10      | 20      | 20  |
| 03112100 | 6   | 9.0N  | 159.4E | 35   | 36 | 113  | 163  | 213 | 250 | 228 | 127 | 115 | 0   | 5  | -5      | -5      | -5      | 10      | 20      | 15  |
| 03112106 | 7   | 9.1N  | 158.2E | 35   | 17 | 74   | 133  | 175 | 211 | 155 | 116 | 96  | 0   | -5 | -<br>15 | -<br>15 | -<br>10 | 10      | 10      | 5   |

| 03112112 | 8  | 9.0N  | 156.8E | 40  | 16 | 54 | 85  | 128 | 153 | 156 | 144 | 316 | -5 | -<br>20 | -<br>20 | -<br>15 | 10      | 5       | 10      | 5   |
|----------|----|-------|--------|-----|----|----|-----|-----|-----|-----|-----|-----|----|---------|---------|---------|---------|---------|---------|-----|
| 03112118 | 9  | 8.8N  | 155.4E | 45  | 5  | 42 | 60  | 88  | 102 | 131 | 176 | 272 | 0  | -5      | 0       | 0       | 5       | 10      | 5       | -15 |
| 03112200 | 10 | 8.8N  | 153.9E | 60  | 13 | 13 | 32  | 68  | 97  | 95  | 97  | 149 | 0  | 5       | 15      | 15      | 20      | 15      | -5      | -10 |
| 03112206 | 11 | 8.8N  | 152.3E | 65  | 5  | 30 | 84  | 112 | 136 | 77  | 106 | 109 | 0  | 5       | 10      | 10      | 20      | 5       | -<br>15 | -10 |
| 03112212 | 12 | 8.8N  | 150.7E | 70  | 13 | 63 | 121 | 175 | 202 | 130 | 169 | 134 | 0  | 0       | 0       | 5       | 10      | 5       | -<br>15 | -15 |
| 03112218 | 13 | 8.8N  | 149.1E | 75  | 8  | 75 | 118 | 181 | 198 | 166 | 216 | 186 | 0  | 0       | 0       | 10      | 10      | 0       | -<br>15 | -5  |
| 03112300 | 14 | 8.2N  | 147.8E | 80  | 18 | 75 | 139 | 187 | 171 | 152 | 169 | 139 | 0  | 0       | 5       | 10      | 10      | -5      | -<br>10 | -5  |
| 03112306 | 15 | 7.9N  | 146.6E | 85  | 0  | 13 | 79  | 89  | 64  | 74  | 55  | 58  | 5  | 5       | 15      | 15      | 10      | -<br>10 | -5      | -5  |
| 03112312 | 16 | 7.8N  | 145.5E | 90  | 0  | 19 | 54  | 51  | 54  | 60  | 35  | 42  | 5  | 10      | 15      | 15      | 10      | -<br>10 | -<br>10 | -10 |
| 03112318 | 17 | 7.8N  | 144.5E | 95  | 18 | 77 | 55  | 30  | 36  | 50  | 75  | 93  | 0  | 15      | 10      | 5       | 10      | -<br>15 | -<br>15 | -10 |
| 03112400 | 18 | 8.1N  | 143.8E | 95  | 25 | 55 | 61  | 76  | 71  | 87  | 122 | 147 | 0  | 5       | 10      | 5       | 0       | -<br>15 | -<br>25 | -10 |
| 03112406 | 19 | 8.5N  | 143.1E | 95  | 18 | 49 | 88  | 113 | 107 | 134 | 163 | 179 | 0  | 0       | -5      | 0       | -<br>15 | -<br>25 | -<br>30 | -5  |
| 03112412 | 20 | 9.1N  | 142.2E | 100 | 0  | 48 | 95  | 82  | 64  | 122 | 138 | 120 | -5 | 0       | -5      | -<br>10 | -<br>20 | -<br>35 | -<br>30 | -5  |
| 03112418 | 21 | 9.9N  | 141.1E | 105 | 8  | 36 | 46  | 30  | 25  | 52  | 58  | 136 |    | 5       | 10      | 0       | 5       |         |         | 40  |
| 03112500 | 22 | 10.7N | 139.9E | 105 | 13 |    | 19  | 30  | 13  | 38  |     | 273 |    |         | 0       | -5      | 0       | 5       | 25      | 35  |
| 03112506 | 23 | 11.4N | 138.7E | 115 | 13 | 21 | 29  | 26  | 13  | 42  | 108 | 324 | 0  | 5       | -5      | 0       | 0       | 0       | 20      | 15  |
| 03112512 | 24 | 12.0N | 137.7E | 115 | 16 | 35 | 45  | 46  | 39  | 46  | 133 | 404 | 0  | -5      | -<br>10 | -5      | -<br>10 | -<br>10 | 10      | 10  |
| 03112518 | 25 | 12.2N | 137.1E | 120 | 0  | 30 | 46  | 42  | 40  | 78  |     | 403 |    | -<br>10 | 0       | 5       |         |         | 30      |     |
| 03112600 | 26 | 12.6N | 136.7E | 130 | 12 |    |     | 48  | 45  |     | 177 |     |    | 5       |         |         | 20      |         |         |     |
| 03112606 | 27 | 13.1N | 136.3E | 140 | 13 |    | 21  | 30  | 18  | 97  |     | 358 |    | 5       |         |         |         |         |         |     |
|          | 28 | 13.6N | 136.0E | 140 | 13 |    |     | 25  | 24  | 59  |     | 348 |    | 10      |         |         | 10      |         |         |     |
|          | 29 | 13.8N | 135.4E | 140 | 5  | 25 | 38  | 34  | 60  | 21  |     | 207 |    | 5       | 15      | 10      |         |         | 20      |     |
| 03112700 | 30 | 14.1N | 134.9E |     | 0  | 12 |     | 41  | 74  | 51  |     | 204 |    | 0       | 15      | 15      |         |         | 25      |     |
|          | 31 | 14.5N | 134.3E | 140 | 5  | 23 | 29  | 53  | 81  | 78  |     | 291 |    | 15      |         |         | 20      |         |         | 15  |
| 03112712 | 32 | 15.0N | 133.8E |     | 0  | 24 | 8   | 40  | 45  | 110 |     |     | 0  |         | 0       | 15      |         |         |         |     |
| 03112718 | 33 | 15.3N | 133.2E | 135 | 0  | 6  | 26  | 58  | 25  |     | 150 |     | 5  | 5       | 5       | 15      |         |         |         |     |
| 03112800 | 34 | 15.6N | 132.8E | 135 | 8  | 35 | 66  | 75  | 73  | 181 | 193 |     | 5  | 0       | 10      | 10      | 0       | 15      | 5       |     |
| 03112806 | 35 | 16.4N | 132.3E | 135 | 11 | 21 | 47  | 21  | 33  | 84  | 158 |     | 5  | 10      | 10      | 0       | -<br>15 | 5       | 5       |     |
| 03112812 | 36 | 17.1N | 131.9E | 135 | 12 | 29 | 40  | 13  | 23  | 77  |     |     | 5  | 10      | 0       | -<br>15 | -<br>20 | 0       |         |     |

| 03112818 | 37 | 17.7N | 131.3E  | 125 | 0  | 26 | 18  | 48  | 81  | 101 |     |     | 0       | 5       | -<br>10 | -<br>25 | -<br>20 | -<br>15 |    |    |
|----------|----|-------|---------|-----|----|----|-----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|----|----|
| 03112900 | 38 | 18.4N | 130.8E  | 115 | 11 | 21 | 89  | 188 | 234 | 175 |     |     | 0       | -<br>10 | -<br>20 | -<br>30 | -<br>20 | -<br>15 |    |    |
| 03112906 | 39 | 19.2N | 130.5E  | 105 | 5  | 34 | 68  | 117 | 84  | 113 |     |     | 0       | -<br>10 | -<br>25 | -<br>15 | -<br>15 | -<br>10 |    |    |
| 03112912 | 40 | 20.1N | 130.9E  | 105 | 13 | 49 | 75  | 101 | 72  |     |     |     | -5      | -<br>15 | -<br>25 | -<br>10 | -<br>10 |         |    |    |
| 03112918 | 41 | 21.1N | 131.7E  | 100 | 21 | 28 | 66  | 73  | 36  |     |     |     | -5      | -<br>15 | -<br>10 | -<br>10 | -<br>15 |         |    |    |
| 03113000 | 42 | 22.1N | 132.6E  | 100 | 26 | 49 | 80  | 82  | 66  |     |     |     | -<br>10 | -<br>20 | -5      | -<br>10 | -<br>10 |         |    |    |
| 03113006 | 43 | 23.3N | 134.0E  | 100 | 28 | 76 | 73  | 35  | 69  |     |     |     | -<br>10 | -5      | 0       | -5      | -5      |         |    |    |
| 03113012 | 44 | 24.6N | 135.4E  | 95  | 13 | 37 | 36  | 24  |     |     |     |     | -<br>10 | 0       | 0       | -5      |         |         |    |    |
| 03113018 | 45 | 25.8N | 137.5E  | 80  | 16 | 89 | 138 | 250 |     |     |     |     | -<br>10 | -<br>10 | -<br>15 | -<br>10 |         |         |    |    |
| 03120100 | 46 | 27.7N | 138.8E  | 70  | 36 | 68 | 117 |     |     |     |     |     | -<br>10 | -<br>15 | -<br>15 |         |         |         |    |    |
| 03120106 | 47 | 29.6N | 140.0E  | 65  | 31 | 57 | 90  |     |     |     |     |     | -5      | -<br>10 | -<br>10 |         |         |         |    |    |
| 03120112 |    | 30.9N | 142.0E  | 60  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120118 |    | 32.2N | 144.3E  | 60  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120200 |    | 34.0N | 146.3E  | 55  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
| 03120206 |    | 35.7N | 148.6E  | 50  |    |    |     |     |     |     |     |     |         |         |         |         |         |         |    |    |
|          |    |       | AVERAGE |     | 12 | 40 | 66  | 83  | 86  | 107 | 138 | 196 | 3       | 7       | 9       | 10      | 11      | 13      | 15 | 14 |
|          |    |       | BIAS    |     |    |    |     |     |     |     |     |     | -1      | 0       | 0       | 1       | 0       | 3       | 5  | 6  |
|          |    |       | # CASES |     | 47 | 47 | 47  | 45  | 43  | 39  | 35  | 31  | 47      | 47      | 47      | 45      | 43      | 39      | 35 | 31 |

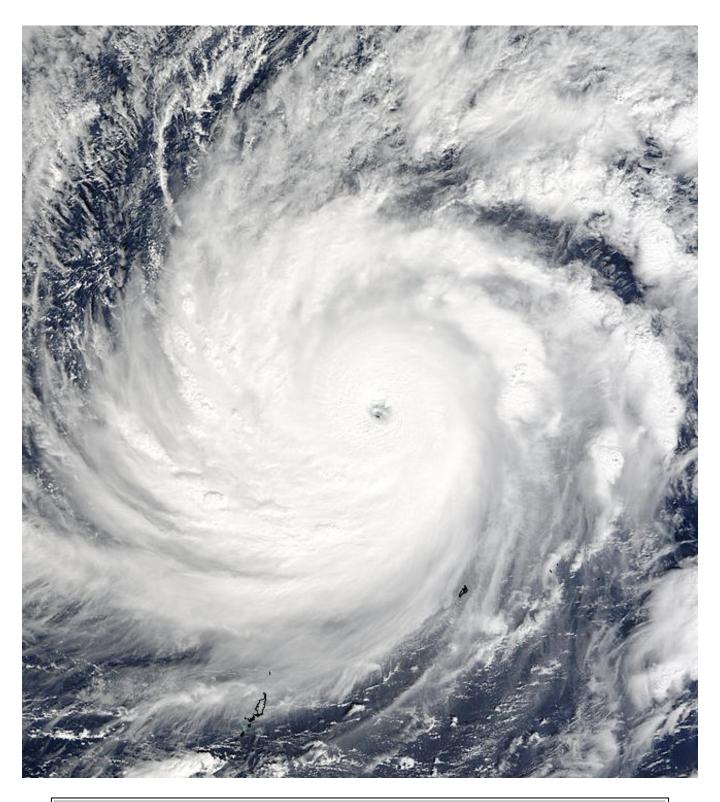


Figure 1-26W-1. 260135Z November 2003 MODIS true color image of 26W (Lupit), north of Yap, with an intensity of 130 knots.

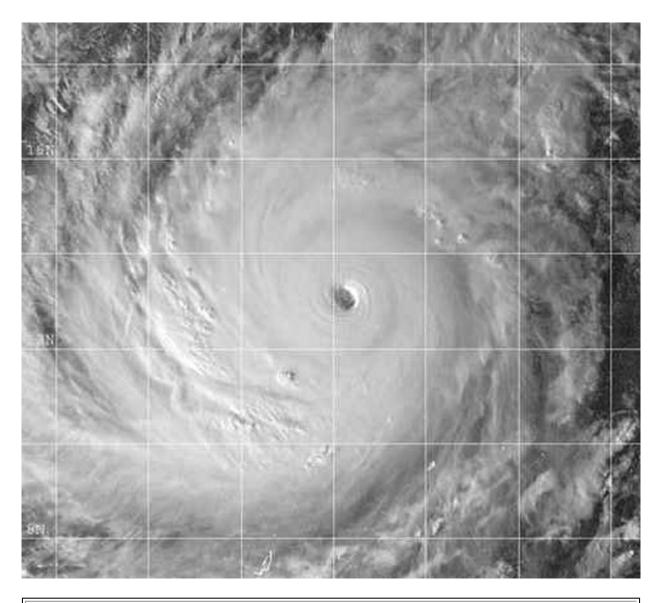


Figure 1-26W-2. 260702Z November 2003 GOES-9 visible satellite image of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

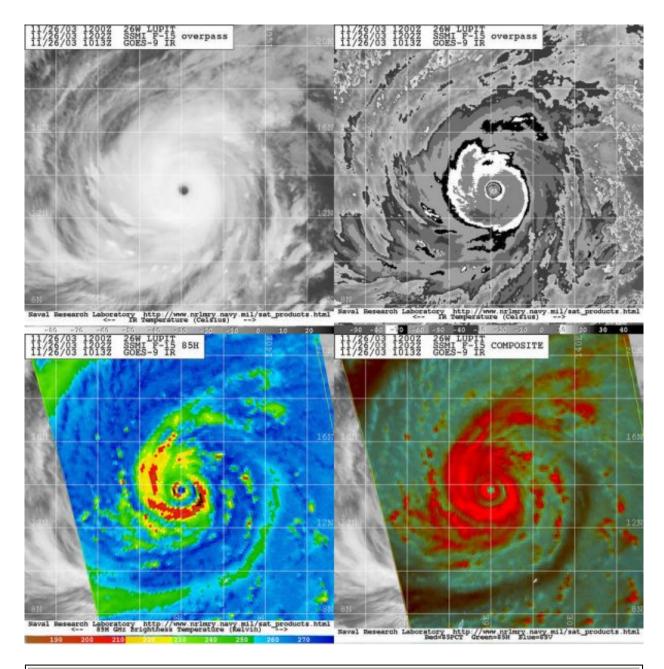
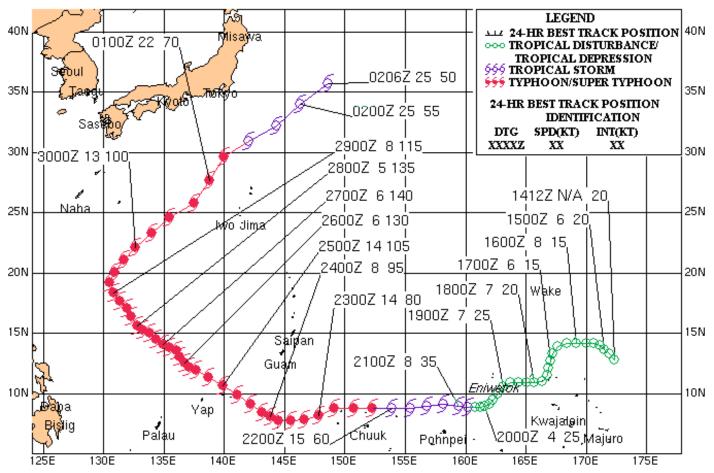
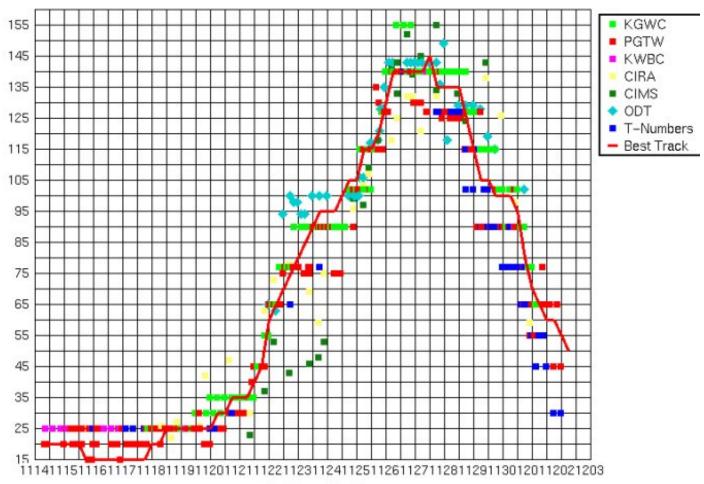


Figure 1-26W-3. 261202Z November 2003 multi-sensor satellite images of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

### SUPER TYPHOON 26W (LUPIT) 20 NOVEMBER - 01 DECEMBER 2003



# Time Intensity for 26W



Fix Date (Zulu)

# **Tropical Storm (TS) 27W**



First Poor: N/A

First Fair: 0600Z 21 Sep 03

First TCFA: 0230Z 24 Dec 03

First Warning: 0600Z 24 Dec 03

Last Warning: 1800Z 27 Dec 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Surigao, Philippines

Total Warnings: 15

#### Remarks:

1) Tropical Storm (TS) 27W developed in the monsoon trough on 21 December, 2003, approximately 150 NM west-southwest of Chuuk and tracked generally westward over the next 6 days as a weak system that intensified to only 35 knots.

The cyclone made landfall near Surigao, Philippines at approximately 1500Z on 27 December and subsequently dissipated in the Bohol Sea.

2) No damage or significant operational impacts were reported for this cyclone.

|     |     |      |       | Statis | tics | for   | JTV  | NC  | on 1 | Γ <b>S</b> 27 | 'W |     |     |      |     |    |    |      |     |    |
|-----|-----|------|-------|--------|------|-------|------|-----|------|---------------|----|-----|-----|------|-----|----|----|------|-----|----|
|     |     |      |       |        |      |       |      |     |      |               |    |     |     |      |     |    |    |      |     |    |
|     | WRN | BEST | TRACK |        | POS  | SITIO | ON E | ERR | ORS  | ;             |    |     | WII | ND I | ERR | OR | S  |      |     |    |
| DTG | NO. | LAT  | LONG  | wind   | 00   | 12 2  | 24   | 36  | 48   | 72            | 96 | 120 | 00  | 12   | 24  | 36 | 48 | 72 9 | 6 1 | 20 |

| •        | •  |       |         |    |    |    |     |     |     |     |    |     |    |    |    |    |  |
|----------|----|-------|---------|----|----|----|-----|-----|-----|-----|----|-----|----|----|----|----|--|
| 03122300 |    | 11.1N | 142.0E  | 20 |    |    |     |     |     |     |    |     |    |    |    |    |  |
| 03122306 |    | 11.6N | 140.6E  | 20 |    |    |     |     |     |     |    |     |    |    |    |    |  |
| 03122312 |    | 12.1N | 139.3E  | 20 |    |    |     |     |     |     |    |     |    |    |    |    |  |
| 03122318 |    | 12.6N | 138.1E  | 20 |    |    |     |     |     |     |    |     |    |    |    |    |  |
| 03122400 |    | 13.1N | 137.0E  | 20 |    |    |     |     |     |     |    |     |    |    |    |    |  |
| 03122406 | 1  | 13.3N | 135.8E  | 25 | 13 | 42 | 102 | 173 | 241 | 449 | 0  | 0   | 5  | 10 | 20 | 10 |  |
| 03122412 | 2  | 13.5N | 134.6E  | 30 | 26 | 75 | 146 | 197 | 262 | 372 | -5 | 0   | 0  | 5  | 10 | 0  |  |
| 03122418 | 3  | 13.7N | 133.4E  | 30 | 8  | 44 | 68  | 83  | 104 | 179 | 0  | 5   | 5  | 10 | 10 | 0  |  |
| 03122500 | 4  | 13.7N | 132.2E  | 30 | 31 | 64 | 76  | 112 | 152 |     | 0  | 0   | 5  | 5  | 0  |    |  |
| 03122506 | 5  | 13.7N | 131.0E  | 30 | 11 | 31 | 47  | 93  | 142 |     | 0  | 0   | 5  | 0  | -5 |    |  |
| 03122512 | 6  | 13.8N | 130.0E  | 35 | 13 | 12 | 77  | 147 | 197 |     | 0  | 5   | 10 | 10 | 5  |    |  |
| 03122518 | 7  | 13.8N | 129.3E  | 35 | 18 | 27 | 70  | 133 | 180 |     | 0  | 5   | 10 | 0  | 5  |    |  |
| 03122600 | 8  | 13.7N | 128.6E  | 35 | 5  | 42 | 95  | 150 |     |     | 0  | 5   | 0  | 0  |    |    |  |
| 03122606 | 9  | 13.4N | 128.0E  | 35 | 21 | 59 | 105 | 145 |     |     | 0  | 0   | -5 | 5  |    |    |  |
| 03122612 | 10 | 13.0N | 127.4E  | 35 | 41 | 83 | 133 |     |     |     | -5 | -10 | -5 |    |    |    |  |
| 03122618 | 11 | 12.3N | 127.1E  | 35 | 48 | 98 | 84  |     |     |     | 0  | -5  | 0  |    |    |    |  |
| 03122700 | 12 | 11.5N | 126.9E  | 35 | 13 | 42 |     |     |     |     | 0  | 5   |    |    |    |    |  |
| 03122706 | 13 | 10.6N | 126.8E  | 35 | 16 | 18 |     |     |     |     | 0  | 5   |    |    |    |    |  |
| 03122712 | 14 | 9.8N  | 126.4E  | 30 | 53 |    |     |     |     |     | 0  |     |    |    |    |    |  |
| 03122718 | 15 | 9.4N  | 125.5E  | 25 | 11 |    |     |     |     |     | 0  |     |    |    |    |    |  |
|          |    |       | AVERAGE |    | 22 | 49 | 91  | 137 | 183 | 333 | 1  | 3   | 5  | 5  | 8  | 3  |  |
|          |    |       | BIAS    |    |    |    |     |     |     |     | -1 | 1   | 3  | 5  | 6  | 3  |  |
|          |    |       | # CASES |    | 15 | 13 | 11  | 9   | 7   | 3   | 15 | 13  | 11 | 9  | 7  | 3  |  |

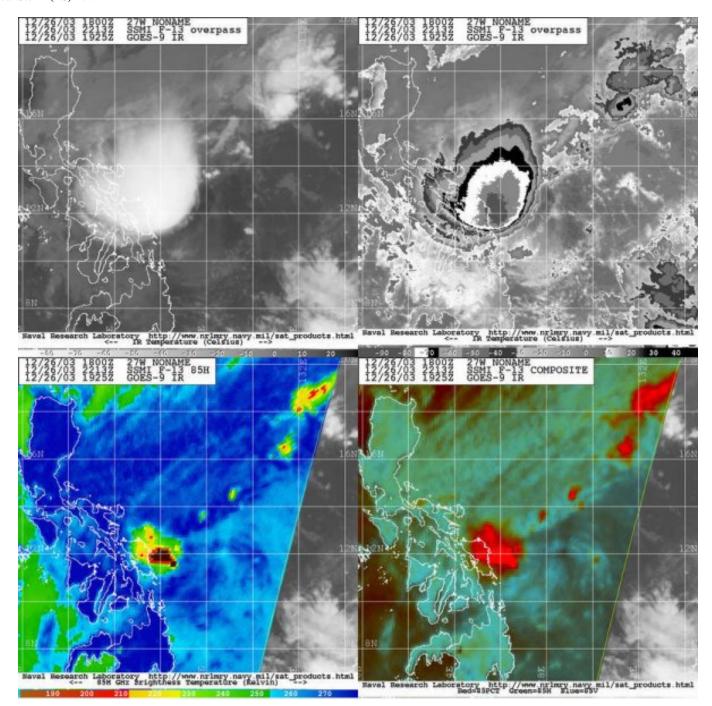
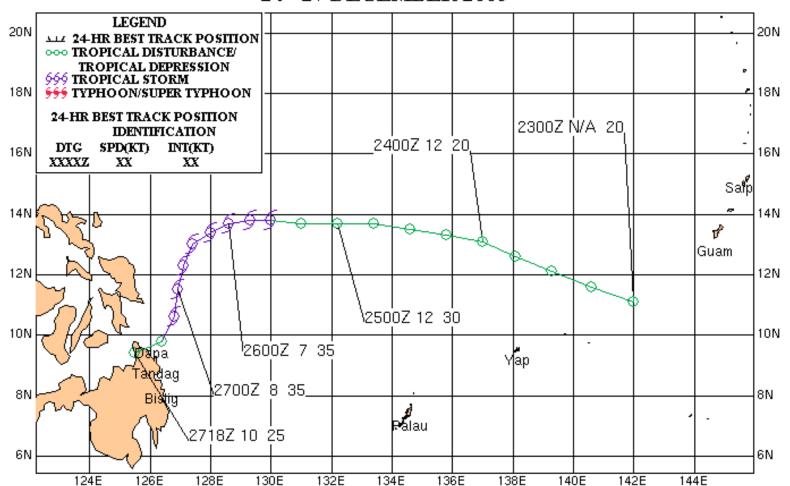
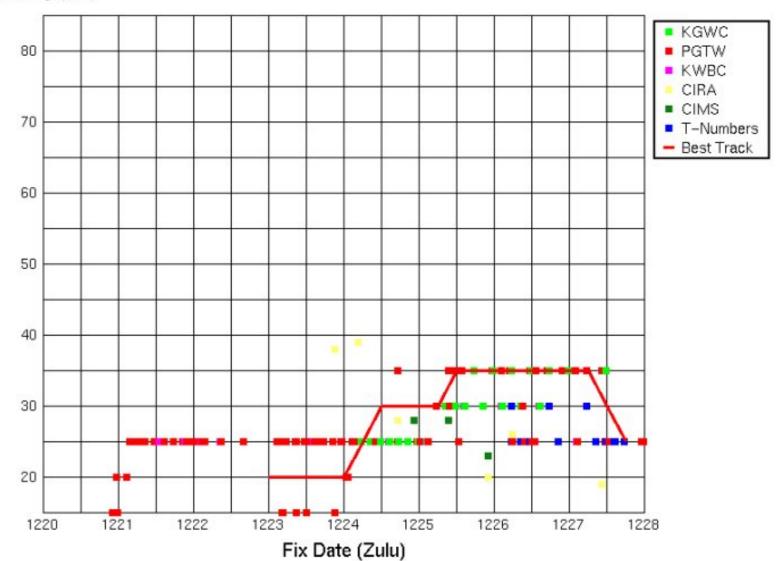


Figure 1-27W-1. 262213Z December 2003 multi-sensor satellite images of TY 27W, revealing a partially exposed low level circulation center 120 nm east of the Philippines, with a peak intensity of 35 knots.

### TROPICAL STORM 27W 24 - 27 DECEMBER 2003



# Time Intensity for 27W



# **Tropical Storm (TS) 27W**



First Poor: N/A

First Fair: 0600Z 21 Sep 03

First TCFA: 0230Z 24 Dec 03

First Warning: 0600Z 24 Dec 03

Last Warning: 1800Z 27 Dec 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Surigao, Philippines

Total Warnings: 15

#### Remarks:

1) Tropical Storm (TS) 27W developed in the monsoon trough on 21 December, 2003, approximately 150 NM west-southwest of Chuuk and tracked generally westward over the next 6 days as a weak system that intensified to only 35 knots.

The cyclone made landfall near Surigao, Philippines at approximately 1500Z on 27 December and subsequently dissipated in the Bohol Sea.

2) No damage or significant operational impacts were reported for this cyclone.

|          |     |        | 5       | Statis | tics | fo  | r JT | WC ( | on T | S27 | W  |     |     |      |     |    |    |    |    |     |
|----------|-----|--------|---------|--------|------|-----|------|------|------|-----|----|-----|-----|------|-----|----|----|----|----|-----|
|          |     |        |         |        |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
|          | WRN | BEST 1 | ΓRACK   |        | РО   | SIT | ION  | ERR  | ORS  |     |    |     | WII | ND E | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind   | 00   | 12  | 24   | 36   | 48   | 72  | 96 | 120 | 00  | 12   | 24  | 36 | 48 | 72 | 96 | 120 |
| 03122300 |     | 11.1N  | 142.0E  | 20     |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
| 03122306 |     | 11.6N  | 140.6E  | 20     |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
| 03122312 |     | 12.1N  | 139.3E  | 20     |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
| 03122318 |     | 12.6N  | 138.1E  | 20     |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
| 03122400 |     | 13.1N  | 137.0E  | 20     |      |     |      |      |      |     |    |     |     |      |     |    |    |    |    |     |
| 03122406 | 1   | 13.3N  | 135.8E  | 25     | 13   | 42  | 102  | 173  | 241  | 449 |    |     | 0   | 0    | 5   | 10 | 20 | 10 |    |     |
| 03122412 | 2   | 13.5N  | 134.6E  | 30     | 26   | 75  | 146  | 197  | 262  | 372 |    |     | -5  | 0    | 0   | 5  | 10 | 0  |    |     |
| 03122418 | 3   | 13.7N  | 133.4E  | 30     | 8    | 44  | 68   | 83   | 104  | 179 |    |     | 0   | 5    | 5   | 10 | 10 | 0  |    |     |
| 03122500 | 4   | 13.7N  | 132.2E  | 30     | 31   | 64  | 76   | 112  | 152  |     |    |     | 0   | 0    | 5   | 5  | 0  |    |    |     |
| 03122506 | 5   | 13.7N  | 131.0E  | 30     | 11   | 31  | 47   | 93   | 142  |     |    |     | 0   | 0    | 5   | 0  | -5 |    |    |     |
| 03122512 | 6   | 13.8N  | 130.0E  | 35     | 13   | 12  | 77   | 147  | 197  |     |    |     | 0   | 5    | 10  | 10 | 5  |    |    |     |
| 03122518 | 7   | 13.8N  | 129.3E  | 35     | 18   | 27  | 70   | 133  | 180  |     |    |     | 0   | 5    | 10  | 0  | 5  |    |    |     |
| 03122600 | 8   | 13.7N  | 128.6E  | 35     | 5    | 42  | 95   | 150  |      |     |    |     | 0   | 5    | 0   | 0  |    |    |    |     |
| 03122606 | 9   | 13.4N  | 128.0E  | 35     | 21   | 59  | 105  | 145  |      |     |    |     | 0   | 0    | -5  | 5  |    |    |    |     |
| 03122612 | 10  | 13.0N  | 127.4E  | 35     | 41   | 83  | 133  |      |      |     |    |     | -5  | -10  | -5  |    |    |    |    |     |
| 03122618 | 11  | 12.3N  | 127.1E  | 35     | 48   | 98  | 84   |      |      |     |    |     | 0   | -5   | 0   |    |    |    |    |     |
| 03122700 | 12  | 11.5N  | 126.9E  | 35     | 13   | 42  |      |      |      |     |    |     | 0   | 5    |     |    |    |    |    |     |
| 03122706 | 13  | 10.6N  | 126.8E  | 35     | 16   | 18  |      |      |      |     |    |     | 0   | 5    |     |    |    |    |    |     |
| 03122712 | 14  | 9.8N   | 126.4E  | 30     | 53   |     |      |      |      |     |    |     | 0   |      |     |    |    |    |    |     |
| 03122718 | 15  | 9.4N   | 125.5E  | 25     | 11   |     |      |      |      |     |    |     | 0   |      |     |    |    |    |    |     |
|          |     |        | AVERAGE |        | 22   | 49  | 91   | 137  | 183  | 333 |    |     | 1   | 3    | 5   | 5  | 8  | 3  |    |     |
|          |     |        | BIAS    |        |      |     |      |      |      |     |    |     | -1  | 1    | 3   | 5  | 6  | 3  |    |     |
|          |     |        | # CASES |        | 15   | 13  | 11   | 9    | 7    | 3   |    |     | 15  | 13   | 11  | 9  | 7  | 3  |    |     |

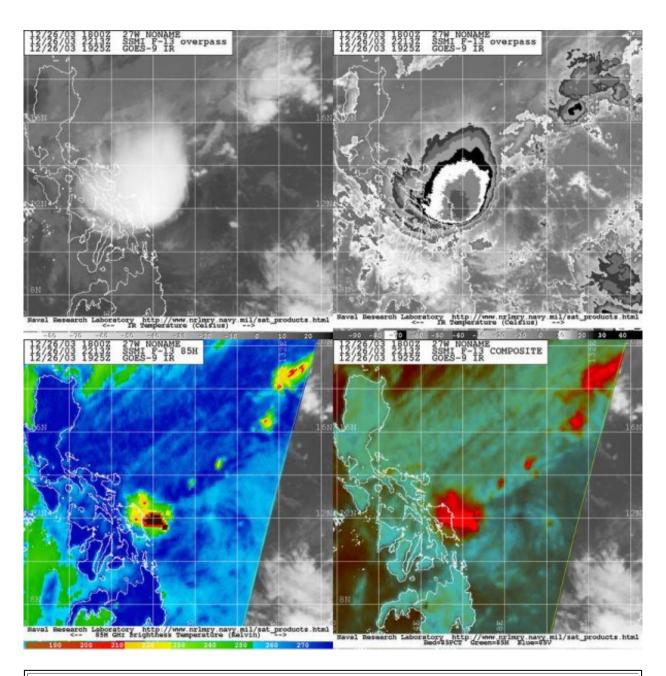
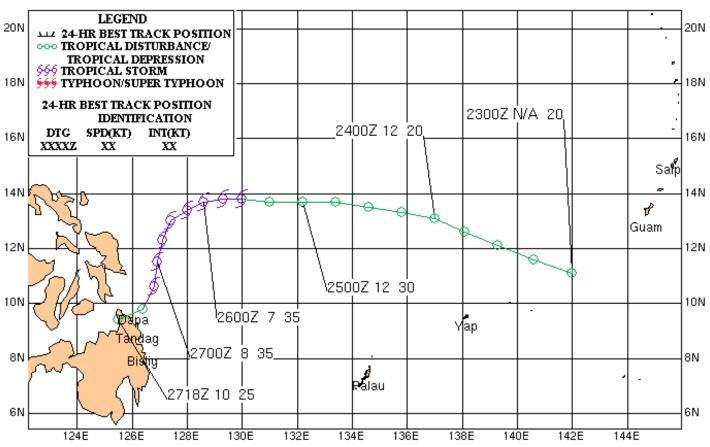
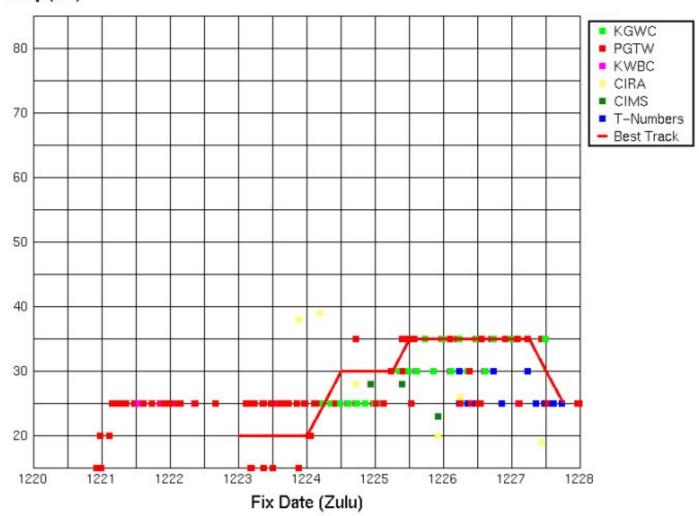


Figure 1-27W-1. 262213Z December 2003 multi-sensor satellite images of TY 27W, revealing a partially exposed low level circulation center 120 nm east of the Philippines, with a peak intensity of 35 knots.

### TROPICAL STORM 27W 24 - 27 DECEMBER 2003



# Time Intensity for 27W



# **Tropical Cyclone (TC) 01B**



First Poor: 0300Z 08 May 03

First Fair: 1300Z 08 May 03

First TCFA: 1730Z 08 May 03

First Warning: 1200Z 10 May 03

Last Warning: 1800Z 19 May 03

Max Intensity: 60 kts, gusts to 75 kts

Landfall: Ramree Island, Myanmar

Total Warnings: 15

Remarks:

1) Tropical Cyclone (TC) 01B, the first significant North Indian Ocean tropical cyclone of 2003, developed out of a broad surface trough approximately 260 NM west of the north tip of Sumatra. The area initially tracked northwestward in a moderately favorable environment of diffluence aloft and low vertical wind shear. The first warning was issued on 10 May at 1200Z.

For approximately 36 hours after the initial warning, the cyclone continued on a northwestward course, with a track speed between 6 and 12 knots. Around 1800Z on 11 May, the cyclone slowed and started moving more northward as a mid-level ridge northeast of the system began building.

By 1800Z on 13 May, satellite imagery revealed a fully exposed low level circulation center to the east of the deep convection. By 0000Z on 16 May, the system entered into a weak steering environment as the mid level steering ridge east of the system began to weaken. The system then shifted to a more northeastward track by 0000Z on 18 May under the influence of a mid-level ridge east of the system and the low to mid-level buffer southeast of the system. TC 01B made landfall with an intensity of 40 knots over Ramree Island, Myanmar, and then quickly dissipated over land.

2) No reports were received of any damage from this cyclone.

|          |     |       |         | Stati | stic | s fo | r JT | WC  | on T | C0 | 1B |     |    |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|------|------|-----|------|----|----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PO   | SITI | ON E | RRC | RS   |    |    |     | WI | ND E | ERR | OR: | S   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12   | 24   | 36  | 48   | 72 | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03050812 |     | 5.0N  | 91.3E   | 15    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050818 |     | 4.8N  | 91.2E   | 20    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050900 |     | 4.5N  | 91.1E   | 20    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050906 |     | 4.2N  | 91.0E   | 25    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050912 |     | 4.4N  | 90.7E   | 25    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050918 |     | 5.1N  | 90.4E   | 25    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051000 |     | 6.0N  | 90.2E   | 25    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051006 |     | 6.9N  | 89.9E   | 25    |      |      |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051012 | 1   | 7.8N  | 89.5E   | 30    | 8    | 34   | 44   | 45  | 136  |    |    |     | 0  | -10  | -15 | -5  | 10  |    |    |     |
| 03051100 | 2   | 9.6N  | 88.0E   | 45    | 30   | 40   | 87   | 158 | 185  |    |    |     | 5  | 0    | 10  | 25  | 35  |    |    |     |
| 03051112 | 3   | 10.6N | 86.8E   | 60    | 5    | 70   | 119  | 148 | 170  |    |    |     | 0  | 5    | 20  | 25  | 40  |    |    |     |
| 03051200 | 4   | 10.4N | 86.4E   | 60    | 38   | 100  | 138  | 156 | 193  |    |    |     | 0  | 5    | 10  | 20  | 30  |    |    |     |
| 03051206 | 5   | 10.9N | 86.4E   | 55    | 18   | 71   | 69   | 87  | 115  |    |    |     | 0  | 0    | 10  | 20  | 30  |    |    |     |
| 03051218 | 6   | 11.8N | 86.8E   | 55    | 0    | 38   | 55   | 63  | 118  |    |    |     | 10 | 25   | 35  | 50  | 70  |    |    |     |
| 03051306 | 7   | 12.6N | 86.1E   | 55    | 6    | 37   | 70   | 128 | 135  |    |    |     | 10 | 15   | 30  | 50  | 50  |    |    |     |
| 03051318 | 8   | 13.2N | 85.9E   | 55    | 5    | 8    | 56   | 126 | 170  |    |    |     | 0  | 5    | 10  | 10  | 5   |    |    |     |
| 03051406 | 9   | 14.2N | 86.0E   | 45    | 11   | 50   | 92   | 131 | 178  |    |    |     | 5  | 10   | 10  | 5   | -5  |    |    |     |
| 03051418 | 10  | 14.7N | 86.7E   | 35    | 8    | 64   | 85   | 133 | 183  |    |    |     | 0  | 10   | 10  | 10  | 15  |    |    |     |
| 03051506 | 11  | 14.4N | 86.2E   | 35    | 49   | 78   | 123  | 180 | 268  |    |    |     | 0  | 0    | -5  | 0   | 0   |    |    |     |
| 03051518 | 12  | 14.4N | 86.8E   | 35    | 24   | 49   | 99   | 150 | 167  |    |    |     | 0  | -5   | 5   | 0   | 10  |    |    |     |
| 03051606 | 13  | 14.2N | 87.1E   | 45    | 39   | 79   | 131  | 146 | 135  |    |    |     | 0  | 5    | 5   | 15  | 15  |    |    |     |
| 03051618 | 14  | 13.7N | 86.8E   | 40    | 48   | 134  | 184  | 180 | 179  |    |    |     | 0  | 0    | 5   | 5   | 5   |    |    |     |
| 03051706 | 15  | 13.1N | 88.3E   | 40    | 93   | 175  | 244  | 308 | 311  |    |    |     | 0  | 10   | 10  | 5   | -10 |    |    |     |
| 03051718 | 16  | 13.7N | 90.2E   | 30    | 44   | 80   | 131  |     |      |    |    |     | 5  | 0    | -5  |     |     |    |    |     |
| 03051818 | 17  | 16.7N | 93.0E   | 30    | 13   | 50   | 66   |     |      |    |    |     | 5  | 5    | -10 |     |     |    |    |     |
| 03051906 | 18  | 18.3N | 93.3E   | 45    | 22   | 19   |      |     |      |    |    |     | 0  | -5   |     |     |     |    |    |     |
| 03051918 | 19  | 19.9N | 94.1E   | 40    | 6    |      |      |     |      |    |    |     | 0  |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 25   | 65   | 105  | 143 | 176  |    |    |     | 2  | 6    | 12  | 16  | 22  |    |    |     |
|          |     |       | BIAS    |       |      |      |      |     |      |    |    |     | 2  | 4    | 8   | 16  | 20  |    |    |     |
|          |     |       | # CASES |       | 19   | 18   | 17   | 15  | 15   |    |    |     | 19 | 18   | 17  | 15  | 15  |    |    |     |

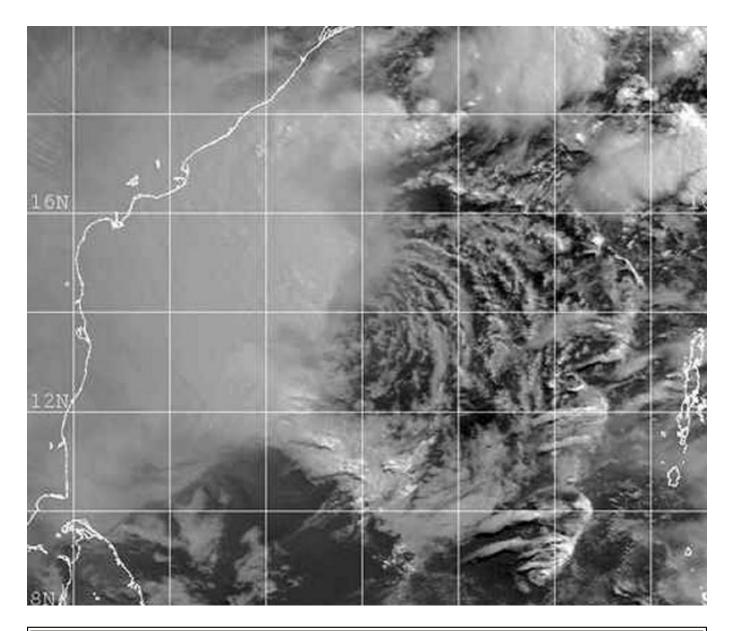


Figure 1-01B-1. 140131Z May 2003 MET-5 visible image of TC 01B, revealing an partially exposed low level circulation, located 360 nm west of the Andaman islands, with an estimated intensity of 50 knots.

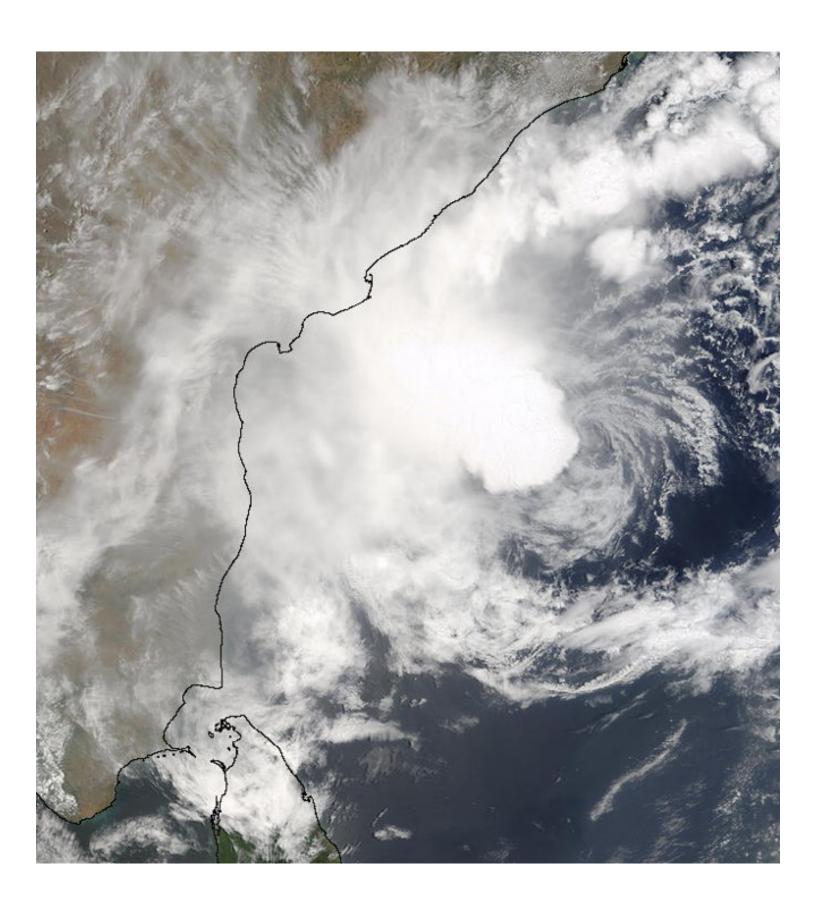
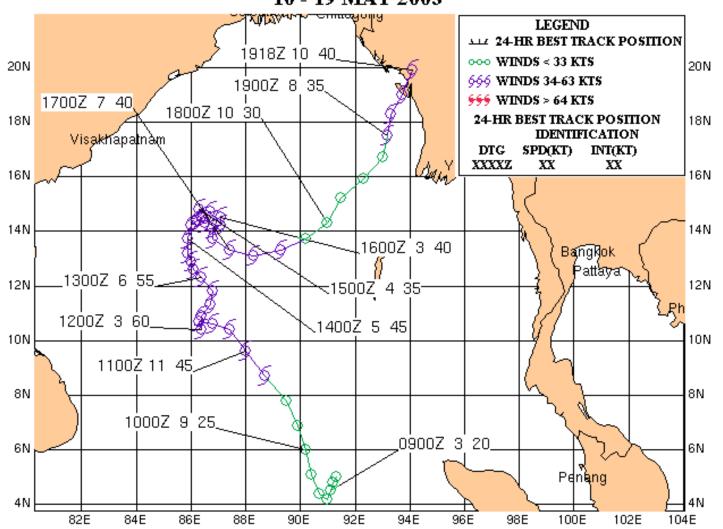
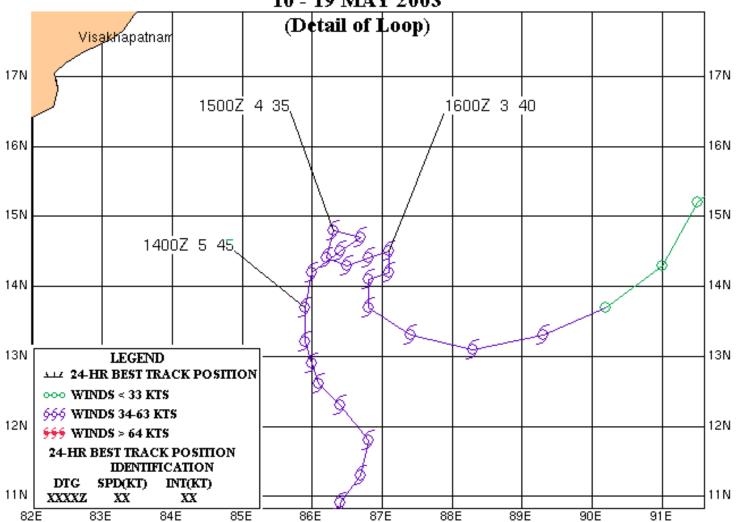


Figure 1-01B-2. 140515Z May 2003 MODIS true-color image of Tropical Cyclone (03B) east of India with an estimated intensity of 45 knots.

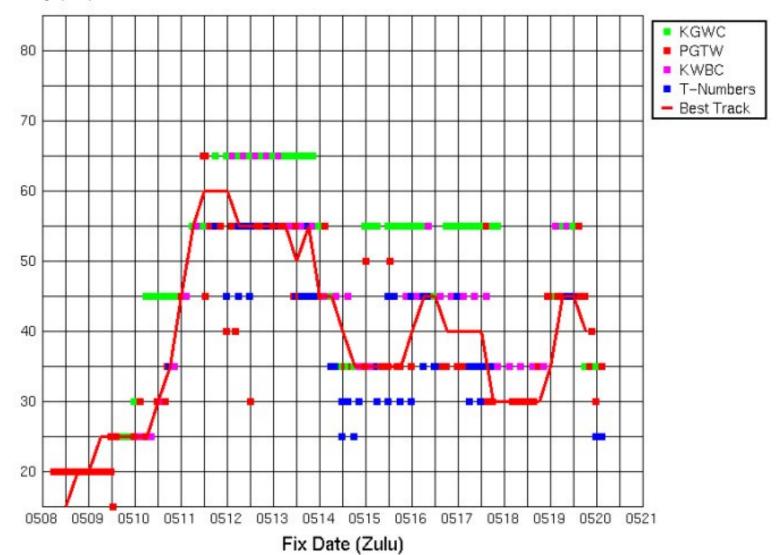
### TROPICAL CYCLONE 01B 10 - 19 MAY 2003



### TROPICAL CYCLONE 01B 10 - 19 MAY 2003



# Time Intensity for 01B



## **Tropical Cyclone (TC) 01B**



First Poor: 0300Z 08 May 03

First Fair : 1300Z 08 May 03

First TCFA: 1730Z 08 May 03

First Warning: 1200Z 10 May 03

Last Warning: 1800Z 19 May 03

Max Intensity: 60 kts, gusts to 75 kts

Landfall: Ramree Island, Myanmar

Total Warnings: 15

Remarks:

1) Tropical Cyclone (TC) 01B, the first significant North Indian Ocean tropical cyclone of 2003, developed out of a broad surface trough approximately 260 NM west of the north tip of Sumatra. The area initially tracked northwestward in a moderately favorable environment of diffluence aloft and low vertical wind shear. The first warning was issued on 10 May at 1200Z.

For approximately 36 hours after the initial warning, the cyclone continued on a northwestward course, with a track speed between 6 and 12 knots. Around 1800Z on 11 May, the cyclone slowed and started moving more northward as a mid-level ridge northeast of the system began building.

By 1800Z on 13 May, satellite imagery revealed a fully exposed low level circulation center to the east of the deep convection. By 0000Z on 16 May, the system entered into a weak steering environment as the mid level steering ridge east of the system began to weaken. The system then shifted to a more northeastward track by 0000Z on 18 May under the influence of a mid-level ridge east of the system and the low to mid-level buffer southeast of the system. TC 01B made landfall with an intensity of 40 knots over Ramree Island, Myanma, and then quickly dissipated over land.

2) No reports were received of any damage from this cyclone.

|          |     |       |         | Stati | stic | s fo  | r JT | WC  | on T | C0 | 1B |     |    |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|-------|------|-----|------|----|----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | РО   | SITIO | ON E | RRC | RS   |    |    |     | WI | ND E | ERR | OR: | S   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12    | 24   | 36  | 48   | 72 | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03050812 |     | 5.0N  | 91.3E   | 15    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050818 |     | 4.8N  | 91.2E   | 20    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050900 |     | 4.5N  | 91.1E   | 20    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050906 |     | 4.2N  | 91.0E   | 25    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050912 |     | 4.4N  | 90.7E   | 25    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03050918 |     | 5.1N  | 90.4E   | 25    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051000 |     | 6.0N  | 90.2E   | 25    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051006 |     | 6.9N  | 89.9E   | 25    |      |       |      |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 03051012 | 1   | 7.8N  | 89.5E   | 30    | 8    | 34    | 44   | 45  | 136  |    |    |     | 0  | -10  | -15 | -5  | 10  |    |    |     |
| 03051100 | 2   | 9.6N  | 88.0E   | 45    | 30   | 40    | 87   | 158 | 185  |    |    |     | 5  | 0    | 10  | 25  | 35  |    |    |     |
| 03051112 | 3   | 10.6N | 86.8E   | 60    | 5    | 70    | 119  | 148 | 170  |    |    |     | 0  | 5    | 20  | 25  | 40  |    |    |     |
| 03051200 | 4   | 10.4N | 86.4E   | 60    | 38   | 100   | 138  | 156 | 193  |    |    |     | 0  | 5    | 10  | 20  | 30  |    |    |     |
| 03051206 | 5   | 10.9N | 86.4E   | 55    | 18   | 71    | 69   | 87  | 115  |    |    |     | 0  | 0    | 10  | 20  | 30  |    |    |     |
| 03051218 | 6   | 11.8N | 86.8E   | 55    | 0    | 38    | 55   | 63  | 118  |    |    |     | 10 | 25   | 35  | 50  | 70  |    |    |     |
| 03051306 | 7   | 12.6N | 86.1E   | 55    | 6    | 37    | 70   | 128 | 135  |    |    |     | 10 | 15   | 30  | 50  | 50  |    |    |     |
| 03051318 | 8   | 13.2N | 85.9E   | 55    | 5    | 8     | 56   | 126 | 170  |    |    |     | 0  | 5    | 10  | 10  | 5   |    |    |     |
| 03051406 | 9   | 14.2N | 86.0E   | 45    | 11   | 50    | 92   | 131 | 178  |    |    |     | 5  | 10   | 10  | 5   | -5  |    |    |     |
| 03051418 | 10  | 14.7N | 86.7E   | 35    | 8    | 64    | 85   | 133 | 183  |    |    |     | 0  | 10   | 10  | 10  | 15  |    |    |     |
| 03051506 | 11  | 14.4N | 86.2E   | 35    | 49   | 78    | 123  | 180 | 268  |    |    |     | 0  | 0    | -5  | 0   | 0   |    |    |     |
| 03051518 | 12  | 14.4N | 86.8E   | 35    | 24   | 49    | 99   | 150 | 167  |    |    |     | 0  | -5   | 5   | 0   | 10  |    |    |     |
| 03051606 | 13  | 14.2N | 87.1E   | 45    | 39   | 79    | 131  | 146 | 135  |    |    |     | 0  | 5    | 5   | 15  | 15  |    |    |     |
| 03051618 | 14  | 13.7N | 86.8E   | 40    | 48   | 134   | 184  | 180 | 179  |    |    |     | 0  | 0    | 5   | 5   | 5   |    |    |     |
| 03051706 | 15  | 13.1N | 88.3E   | 40    | 93   | 175   | 244  | 308 | 311  |    |    |     | 0  | 10   | 10  | 5   | -10 |    |    |     |
| 03051718 | 16  | 13.7N | 90.2E   | 30    | 44   | 80    | 131  |     |      |    |    |     | 5  | 0    | -5  |     |     |    |    |     |
| 03051818 | 17  | 16.7N | 93.0E   | 30    | 13   | 50    | 66   |     |      |    |    |     | 5  | 5    | -10 |     |     |    |    |     |
| 03051906 | 18  | 18.3N | 93.3E   | 45    | 22   | 19    |      |     |      |    |    |     | 0  | -5   |     |     |     |    |    |     |
| 03051918 | 19  | 19.9N | 94.1E   | 40    | 6    |       |      |     |      |    |    |     | 0  |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 25   | 65    | 105  | 143 | 176  |    |    |     | 2  | 6    | 12  | 16  | 22  |    |    |     |
|          |     |       | BIAS    |       |      |       |      |     |      |    |    |     | 2  | 4    | 8   | 16  | 20  |    |    |     |
|          |     |       | # CASES |       | 19   | 18    | 17   | 15  | 15   |    |    |     | 19 | 18   | 17  | 15  | 15  |    |    |     |

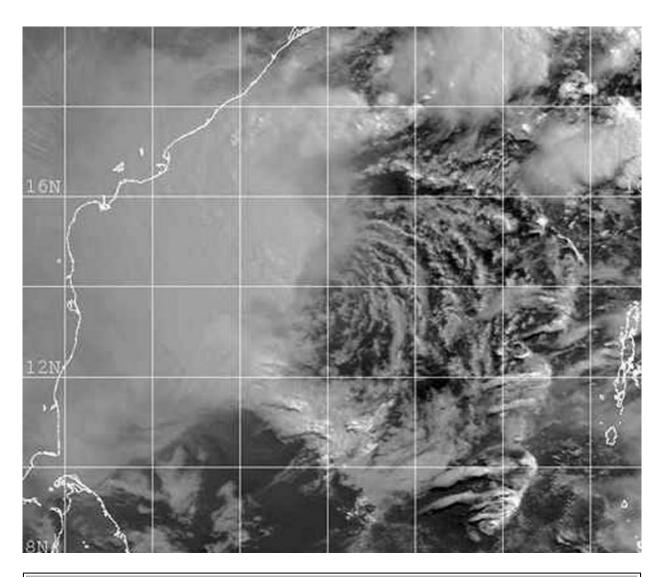


Figure 1-01B-1. 140131Z May 2003 MET-5 visible image of TC 01B, revealing an partially exposed low level circulation, located 360 nm west of the Andaman islands, with an estimated intensity of 50 knots.

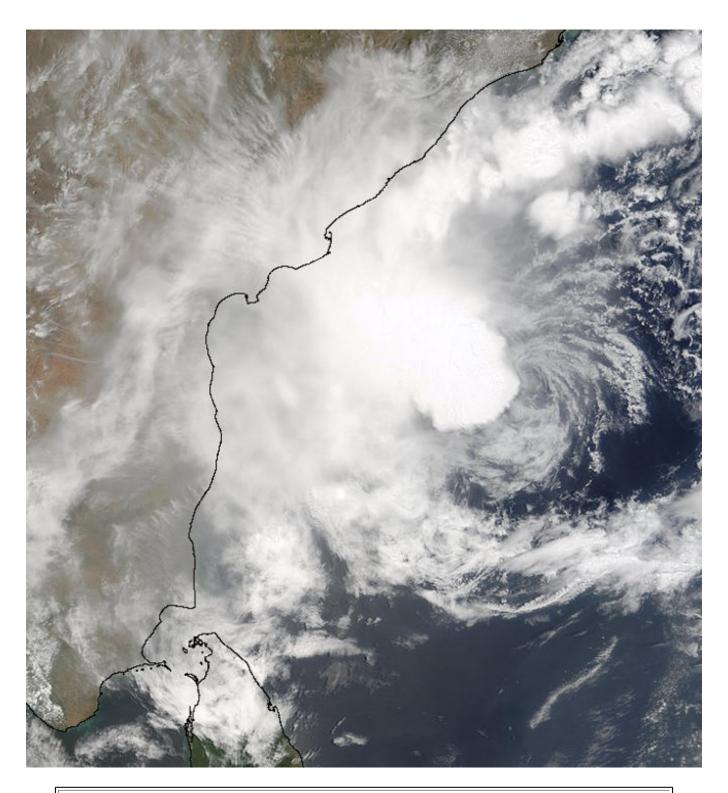
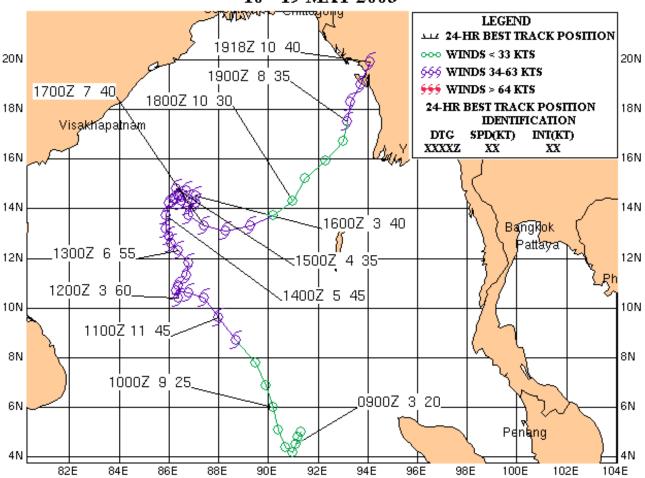


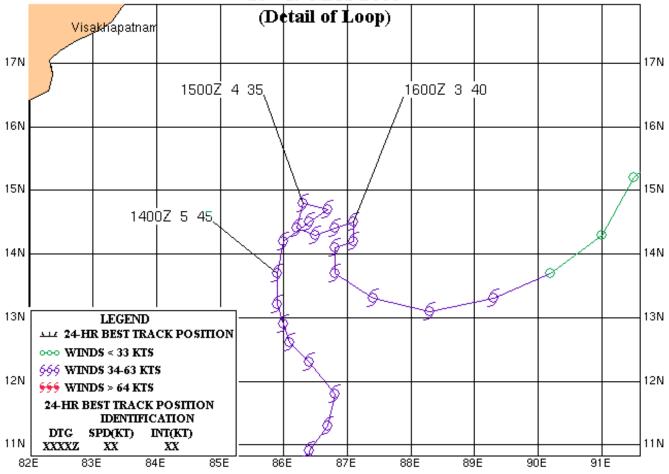
Figure 1-01B-2. 140515Z May 2003 MODIS true-color image of Tropical Cyclone (03B) east of India with an estimated intensity of 45 knots.

### TROPICAL CYCLONE 01B 10 - 19 MAY 2003

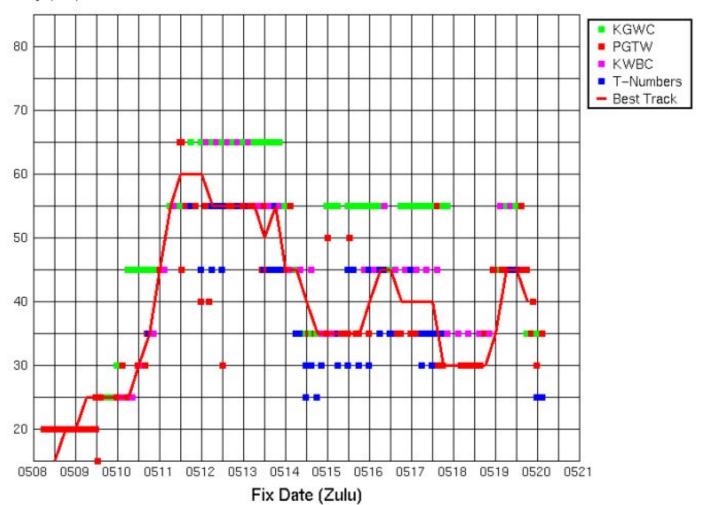


# TROPICAL CYCLONE 01B





# Time Intensity for 01B



### **Tropical Cyclone (TC) 02A**



First Poor: 0900Z 11 Nov 03

First Fair: 1800Z 11 Nov 03

First TCFA: 0500Z 12 Nov 03

First Warning: 1200Z 12 Nov 03

Last Warning: 0600Z 15 Nov 03

Max Intensity: 80 kts, gusts to 100 kts

Landfall: N/A

Total Warnings: 11

Remarks:

(1) TC 02A was first noted as an area of developing convection, approximately 600 nm west of Cochin, India, in the Arabian Sea. The system quickly became more organized and the first warning was issued on 12 November. TC 02A continued to intensify, reaching a maximum intensity of 80 knots. TC 02A tracked along the southern periphery of a low to mid tropospheric subtropical ridge located north and west of the cyclone throughout the cyclone life span. By 0600Z on the 15th, microwave imagery revealed that deep convection became decoupled from the low level circulation and a final warning was issued.

Subsequent to the final warning, the low level circulation center was tracked by satellite for a further 72 hours, at which time the cyclone dissipated completely over water.

(2) No damage reports were received associated with this system.

|          |     |      |         | Sta  | tist | ics f | or J | TWC | on  | TC  | )2A |     |     |      |     |     |     |     |    |     |
|----------|-----|------|---------|------|------|-------|------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|----|-----|
|          |     |      |         |      |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
|          | WRN | BEST | TRACK   |      | PC   | SITI  | ON E | RRC | RS  |     |     |     | WII | ND E | ERR | ORS | 3   |     |    |     |
| DTG      | NO. | LAT  | LONG    | wind | 00   | 12    | 24   | 36  | 48  | 72  | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 03111012 |     | 8.7N | 67.1E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111018 |     | 8.5N | 66.4E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111100 |     | 8.3N | 65.7E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111106 |     | 8.0N | 65.1E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111112 |     | 7.6N | 64.2E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111118 |     | 7.1N | 63.0E   | 15   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111200 |     | 6.5N | 61.6E   | 20   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111206 |     | 6.2N | 60.6E   | 25   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111212 | 1   | 6.1N | 60.0E   | 30   | 11   | 43    | 80   | 86  | 70  |     |     |     | 0   | -20  | -25 | -30 | -15 |     |    |     |
| 03111300 | 2   | 6.2N | 58.8E   | 55   | 18   | 38    | 36   | 46  | 103 |     |     |     | 0   | 0    | 0   | 20  | 55  |     |    |     |
| 03111306 | 3   | 6.2N | 58.2E   | 60   | 5    | 0     | 25   | 54  | 119 | 230 |     |     | 0   | 0    | 0   | 45  | 60  | 45  |    |     |
| 03111312 | 4   | 6.1N | 57.6E   | 65   | 5    | 8     | 32   | 90  | 173 | 280 |     |     | 0   | 0    | 15  | 45  | 50  | 35  |    |     |
| 03111318 | 5   | 6.1N | 57.0E   | 70   | 11   | 35    | 34   | 104 | 171 | 367 |     |     | 5   | 0    | 35  | 55  | 45  | -10 |    |     |
| 03111400 | 6   | 5.9N | 56.2E   | 75   | 5    | 40    | 108  | 198 | 289 | 414 |     |     | 10  | 40   | 50  | 45  | 35  | -10 |    |     |
| 03111406 | 7   | 5.7N | 55.7E   | 80   | 13   | 48    | 131  | 203 | 276 | 435 |     |     | 5   | 35   | 45  | 35  | 25  | -5  |    |     |
| 03111412 | 8   | 5.8N | 55.2E   | 65   | 43   | 129   | 228  | 322 | 405 |     |     |     | 0   | 15   | 15  | 5   | -10 |     |    |     |
| 03111418 | 9   | 5.9N | 54.8E   | 50   | 5    | 101   | 191  | 258 | 376 |     |     |     | 0   | 10   | 0   | -5  | -10 |     |    |     |
| 03111500 | 10  | 6.0N | 54.6E   | 40   | 65   | 173   | 270  | 371 |     |     |     |     | 0   | 0    | -5  | -10 |     |     |    |     |
| 03111506 | 11  | 6.0N | 54.4E   | 30   | 30   | 102   | 208  | 326 |     |     |     |     | 0   | -5   | -10 | -15 |     |     |    |     |
| 03111512 |     | 6.0N | 54.1E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111518 |     | 6.0N | 53.8E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111600 |     | 5.9N | 53.5E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111606 |     | 5.8N | 53.2E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111612 |     | 5.6N | 52.8E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111618 |     | 5.0N | 52.3E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111700 |     | 4.4N | 51.7E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111706 |     | 3.7N | 51.5E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111712 |     | 3.2N | 51.5E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111718 |     | 2.7N | 51.6E   | 30   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111800 |     | 2.5N | 51.8E   | 25   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
| 03111806 |     | 2.4N | 52.0E   | 25   |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |
|          |     |      | AVERAGE |      | 20   | 65    | 122  | 187 | 220 | 345 |     |     | 2   | 11   | 18  | 28  | 34  | 21  |    |     |
|          |     |      | BIAS    |      |      |       |      |     |     |     |     |     | 2   | 7    | 11  | 17  | 26  | 11  |    |     |
|          |     |      |         |      |      |       |      |     |     |     |     |     |     |      |     |     |     |     |    |     |

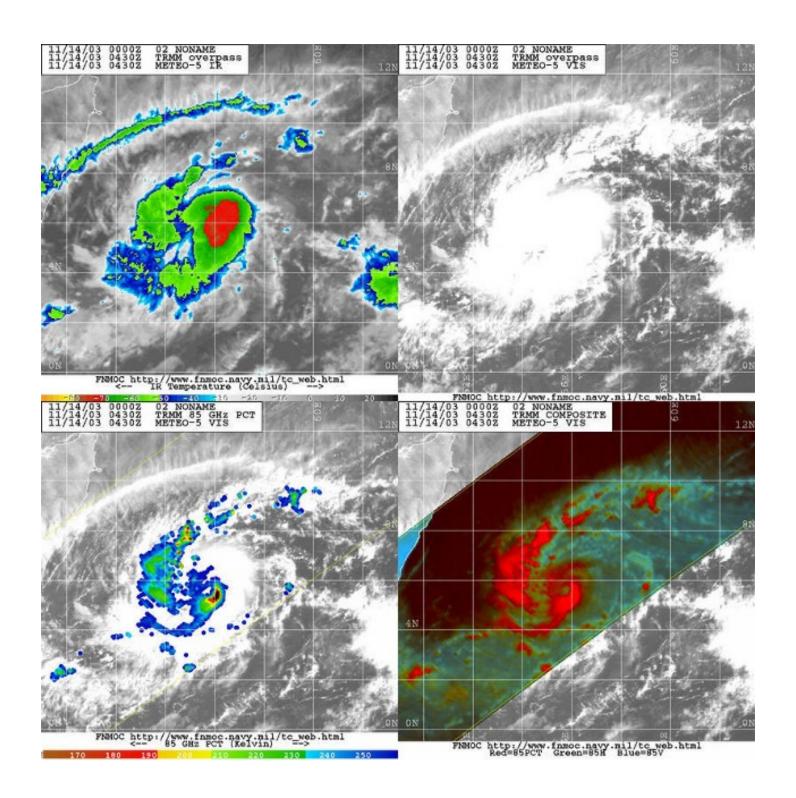
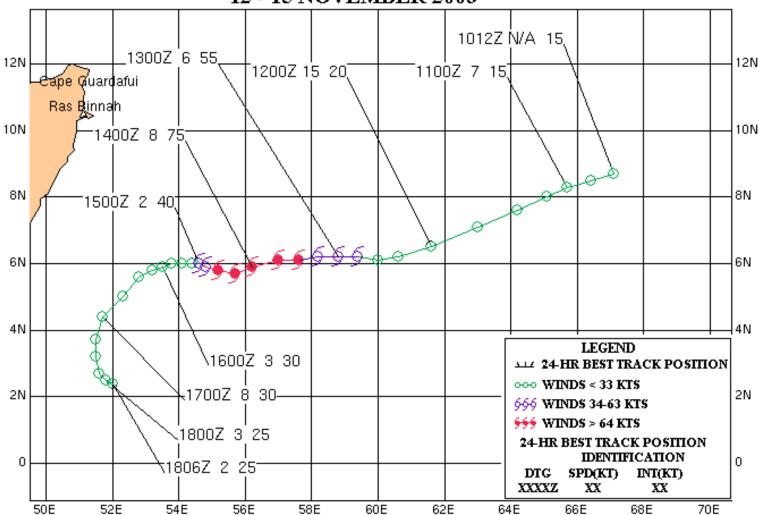


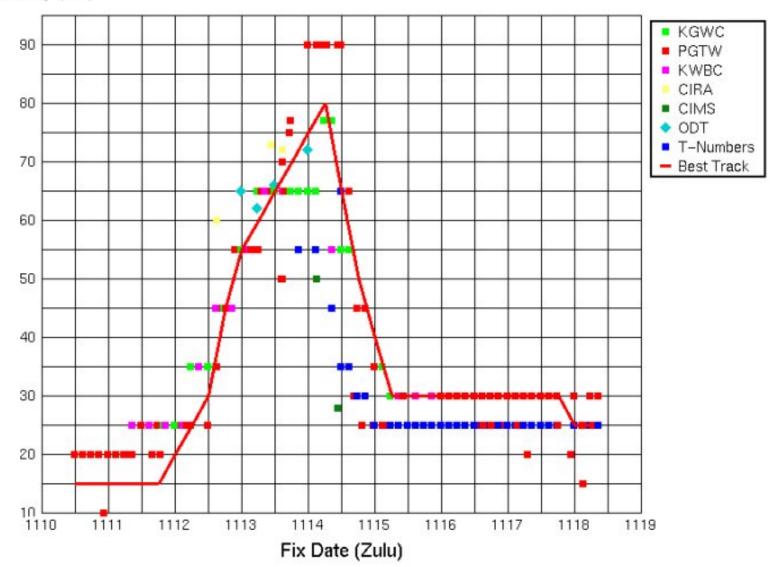
Figure 1-02A-1. 140430Z November 2003 multi-sensor satellite images of TC 02A, located 650 nm northeast of the Mogadishu, with an peak intensity of 85 knots.

#### TROPICAL CYCLONE 02A 12 - 15 NOVEMBER 2003



# Time Intensity for 02A

#### Intensity (kts)



#### **Tropical Cyclone (TC) 02A**



First Poor: 0900Z 11 Nov 03

First Fair: 1800Z 11 Nov 03

First TCFA: 0500Z 12 Nov 03

First Warning: 1200Z 12 Nov 03

Last Warning: 0600Z 15 Nov 03

Max Intensity: 80 kts, gusts to 100 kts

Landfall: N/A

Total Warnings: 11

Remarks:

(1) TC 02A was first noted as an area of developing convection on 11 November, approximately 600 nm west of Cochin, India, in the Arabian Sea. The system quickly became more organized and the first warning was issued one day later by JTWC. TC 02A continued to intensify and reached a maximum intensity of 80 knots. TC 02A tracked along the southern periphery of a low to mid tropospheric subtropical ridge located north and west of the cyclone throughout the cyclone life span. By 0600Z on the 15th, microwave imagery revealed that deep convection became decoupled from the low level circulation and a final warning was issued.

Subsequent to the final warning, the low level circulation center was tracked by satellite for a further 72 hours, at which time the cyclone dissipated completely over water.

(2) No damage reports were received associated with this system.

#### Statistics for JTWC on TC02A

|          | WRN | BEST | TRACK   |      | PC | SITI | ON E | RRC | RS  |     |    |     | WI | ND I | ERR | ORS | 3   |     |    |     |
|----------|-----|------|---------|------|----|------|------|-----|-----|-----|----|-----|----|------|-----|-----|-----|-----|----|-----|
| DTG      | NO. | LAT  | LONG    | wind | 00 | 12   | 24   | 36  | 48  | 72  | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 03111012 |     | 8.7N | 67.1E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111018 |     | 8.5N | 66.4E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111100 |     | 8.3N | 65.7E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111106 |     | 8.0N | 65.1E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111112 |     | 7.6N | 64.2E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111118 |     | 7.1N | 63.0E   | 15   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111200 |     | 6.5N | 61.6E   | 20   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111206 |     | 6.2N | 60.6E   | 25   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111212 | 1   | 6.1N | 60.0E   | 30   | 11 | 43   | 80   | 86  | 70  |     |    |     | 0  | -20  | -25 | -30 | -15 |     |    |     |
| 03111300 | 2   | 6.2N | 58.8E   | 55   | 18 | 38   | 36   | 46  | 103 |     |    |     | 0  | 0    | 0   | 20  | 55  |     |    |     |
| 03111306 | 3   | 6.2N | 58.2E   | 60   | 5  | 0    | 25   | 54  | 119 | 230 |    |     | 0  | 0    | 0   | 45  | 60  | 45  |    |     |
| 03111312 | 4   | 6.1N | 57.6E   | 65   | 5  | 8    | 32   | 90  | 173 | 280 |    |     | 0  | 0    | 15  | 45  | 50  | 35  |    |     |
| 03111318 | 5   | 6.1N | 57.0E   | 70   | 11 | 35   | 34   | 104 | 171 | 367 |    |     | 5  | 0    | 35  | 55  | 45  | -10 |    |     |
| 03111400 | 6   | 5.9N | 56.2E   | 75   | 5  | 40   | 108  | 198 | 289 | 414 |    |     | 10 | 40   | 50  | 45  | 35  | -10 |    |     |
| 03111406 | 7   | 5.7N | 55.7E   | 80   | 13 | 48   | 131  | 203 | 276 | 435 |    |     | 5  | 35   | 45  | 35  | 25  | -5  |    |     |
| 03111412 | 8   | 5.8N | 55.2E   | 65   | 43 | 129  | 228  | 322 | 405 |     |    |     | 0  | 15   | 15  | 5   | -10 |     |    |     |
| 03111418 | 9   | 5.9N | 54.8E   | 50   | 5  | 101  | 191  | 258 | 376 |     |    |     | 0  | 10   | 0   | -5  | -10 |     |    |     |
| 03111500 | 10  | 6.0N | 54.6E   | 40   | 65 | 173  | 270  | 371 |     |     |    |     | 0  | 0    | -5  | -10 |     |     |    |     |
| 03111506 | 11  | 6.0N | 54.4E   | 30   | 30 | 102  | 208  | 326 |     |     |    |     | 0  | -5   | -10 | -15 |     |     |    |     |
| 03111512 |     | 6.0N | 54.1E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111518 |     | 6.0N | 53.8E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111600 |     | 5.9N | 53.5E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111606 |     | 5.8N | 53.2E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111612 |     | 5.6N | 52.8E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111618 |     | 5.0N | 52.3E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111700 |     | 4.4N | 51.7E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111706 |     | 3.7N | 51.5E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111712 |     | 3.2N | 51.5E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111718 |     | 2.7N | 51.6E   | 30   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111800 |     | 2.5N | 51.8E   | 25   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03111806 |     | 2.4N | 52.0E   | 25   |    |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
|          |     |      | AVERAGE |      | 20 | 65   | 122  | 187 | 220 | 345 |    |     | 2  | 11   | 18  | 28  | 34  | 21  |    |     |
|          |     |      | BIAS    |      |    |      |      |     |     |     |    |     | 2  | 7    | 11  | 17  | 26  | 11  |    |     |
|          |     |      | # CASES |      | 11 | 11   | 11   | 11  | 9   | 5   |    |     | 11 | 11   | 11  | 11  | 9   | 5   |    |     |

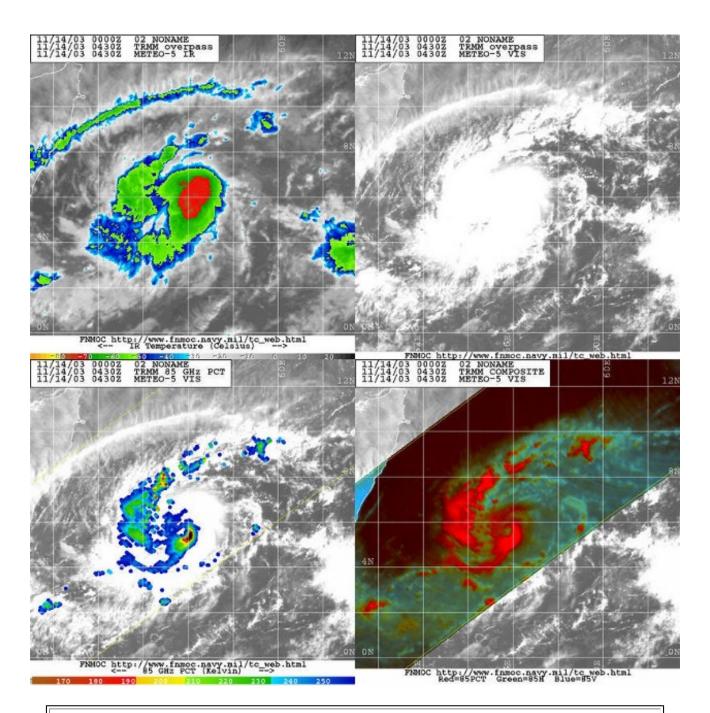
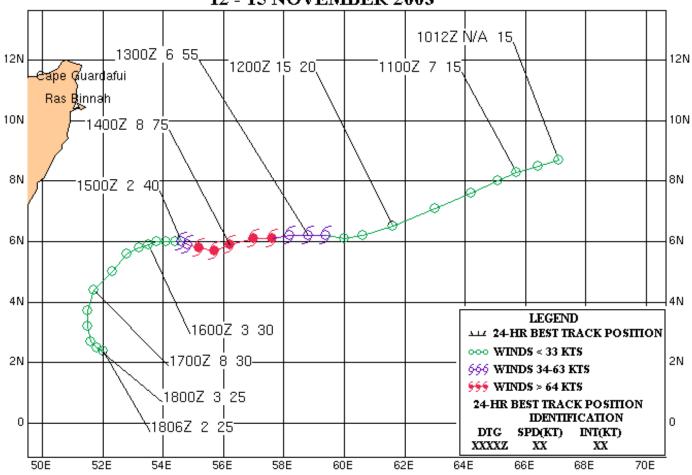


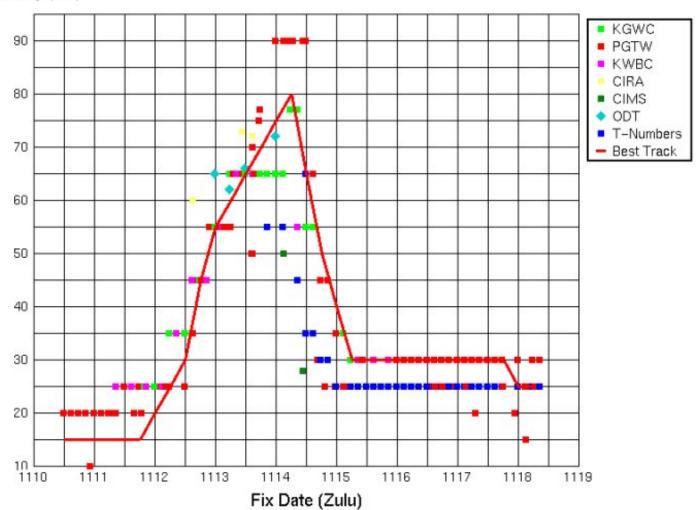
Figure 1-02A-1. 140430Z November 2003 multi-sensor satellite images of TC 02A, located 650 nm northeast of the Mogadishu, with an peak intensity of 85 knots.

#### TROPICAL CYCLONE 02A 12 - 15 NOVEMBER 2003



# Time Intensity for 02A

#### Intensity (kts)



### **Tropical Cyclone (TC) 03B**



First Poor: 05300Z 10 Dec 03

First Fair: 0600Z 11 Dec 03

First TCFA: 1430Z 12 Dec 03

First Warning: 1800Z 12 Dec 03

Last Warning: 1800Z 15 Dec 03, Dissipation

Max Intensity: 55 kts, gusts to 70 kts

Landfall: Near False Divi Point, India

Total Warnings: 7

Remarks:

- (1) Tropical Cyclone (TC) 03B formed off the northwest coast of Summatra and tracked northwestward along the periphery of the low to mid-level steering ridge while slowly intensifying. The cyclone reached a peak intensity of 55 knots before making landfall near False Divi Point, India on 15 December, 2003 at approximately 1430Z.
- (2) Reports indicate that there were 27 fatalities and more than 5100 homes damaged by heavy flooding and high winds. Uprooted trees and damaged electrical tranformers created extensive power outages in India.

|     |     |      |       | Stati | stics | s fo | or J | TWO | C on | TC | )3B  |     |     |      |     |       |     |    |    |     |
|-----|-----|------|-------|-------|-------|------|------|-----|------|----|------|-----|-----|------|-----|-------|-----|----|----|-----|
|     |     |      |       |       |       |      |      |     |      |    |      |     |     |      |     |       |     |    |    |     |
|     | WRN | BEST | TRACK |       | POS   | SITI | ION  | ERR | ORS  | 3  |      |     | WIN | ND E | ERR | ORS   |     |    |    |     |
| DTG | NO. | LAT  | LONG  | wind  | 00    | 12   | 24   | 36  | 48   | 72 | 96 1 | 120 | 00  | 12   | 24  | 36 48 | 8 7 | 72 | 96 | 120 |

|          |   | ,     |         |    |    |    |     |     |     |     | <br> |   |     |    |    |     |     |  |
|----------|---|-------|---------|----|----|----|-----|-----|-----|-----|------|---|-----|----|----|-----|-----|--|
| 03121106 |   | 4.5N  | 91.7E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121112 |   | 5.0N  | 90.7E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121118 |   | 5.6N  | 89.8E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121200 |   | 6.4N  | 89.0E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121206 |   | 7.3N  | 88.9E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121212 |   | 7.7N  | 88.7E   | 25 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121218 | 1 | 7.9N  | 88.4E   | 30 | 24 | 47 | 55  | 96  | 151 | 293 |      | 0 | 5   | 5  | 0  | 5   | -15 |  |
| 03121306 | 2 | 8.4N  | 87.5E   | 30 | 8  | 42 | 109 | 182 | 276 | 458 |      | 0 | 0   | -5 | 0  | -10 | 0   |  |
| 03121318 | 3 | 9.3N  | 86.1E   | 35 | 21 | 78 | 139 | 223 | 311 |     |      | 0 | -5  | 0  | -5 | 10  |     |  |
| 03121406 | 4 | 10.8N | 84.7E   | 45 | 11 | 36 | 99  | 150 | 212 |     |      | 0 | 5   | 0  | 5  | 10  |     |  |
| 03121418 | 5 | 12.4N | 83.2E   | 45 | 29 | 91 | 134 | 189 |     |     |      | 0 | -10 | 5  | 25 |     |     |  |
| 03121506 | 6 | 14.6N | 81.6E   | 55 | 13 | 37 | 80  |     |     |     |      | 0 | 5   | 10 |    |     |     |  |
| 03121518 | 7 | 16.6N | 81.1E   | 45 | 12 | 12 |     |     |     |     |      | 5 | 0   |    |    |     |     |  |
| 03121600 |   | 17.7N | 81.3E   | 35 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
| 03121606 |   | 18.4N | 81.6E   | 30 |    |    |     |     |     |     |      |   |     |    |    |     |     |  |
|          |   |       | AVERAGE |    | 17 | 49 | 103 | 168 | 238 | 375 |      | 1 | 4   | 4  | 7  | 9   | 8   |  |
|          |   |       | BIAS    |    |    |    |     |     |     |     |      | 1 | 0   | 3  | 5  | 4   | -8  |  |
|          |   |       | # CASES |    | 7  | 7  | 6   | 5   | 4   | 2   |      | 7 | 7   | 6  | 5  | 4   | 2   |  |

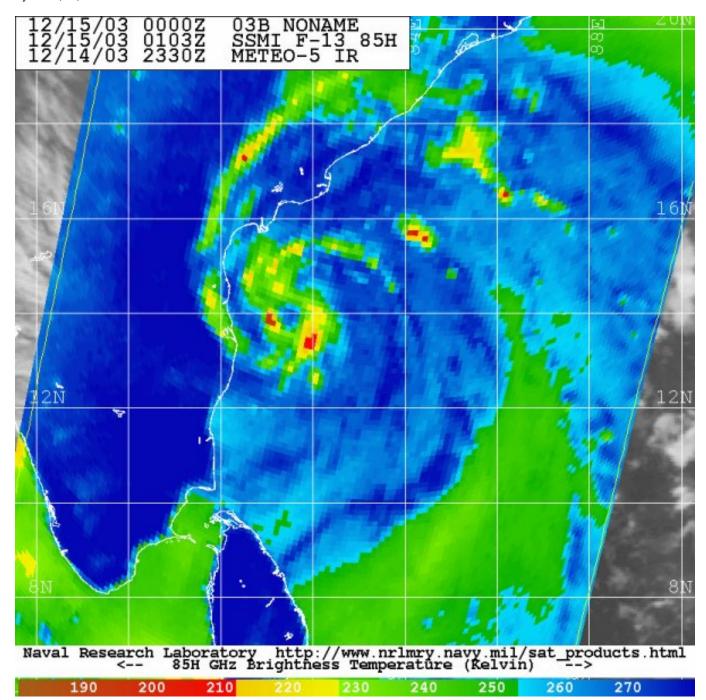


Figure 1-03B-1. 150103Z December 2003 SSM/I imagery of TC 03B, the banding eye was located 115 nm east of the Madras, with an intensity of 50 knots.

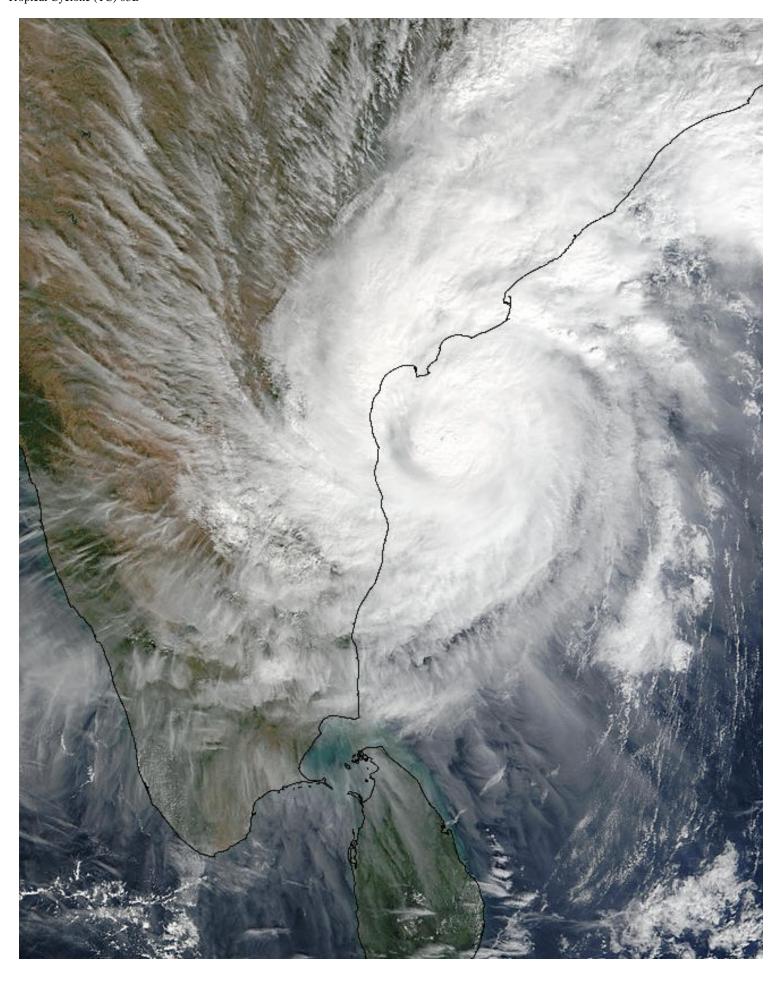
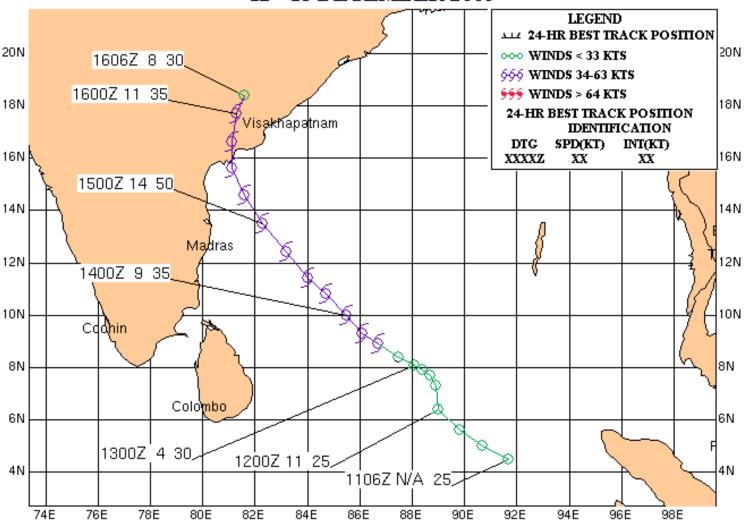


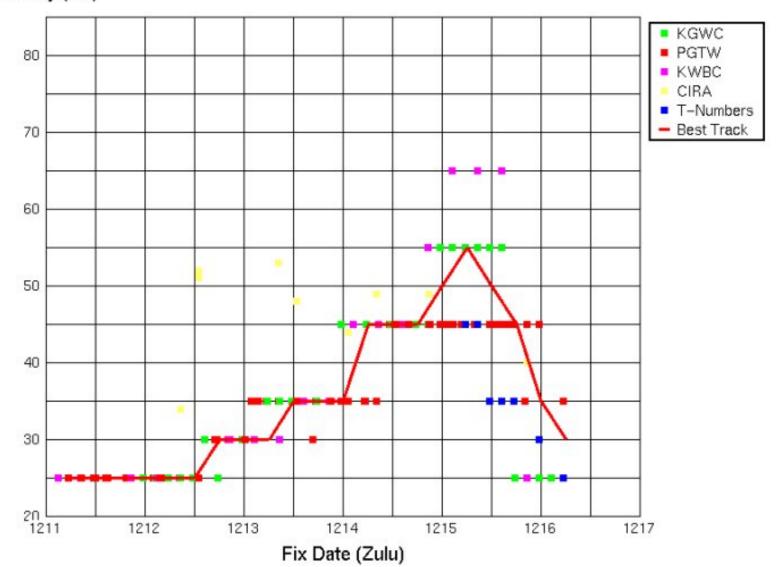
Figure 1-03B-2. 150520Z December 2003 MODIS true-color image of TC 03B, located off the east coast of India, with an intensity of 55 knots.

#### TROPICAL CYCLONE 03B 12 - 15 DECEMBER 2003



# Time Intensity for 03B

#### Intensity (kts)



#### **Tropical Cyclone (TC) 03B**



First Poor : 05300Z 10 Dec 03

First Fair: 0600Z 11 Dec 03

First TCFA: 1430Z 12 Dec 03

First Warning: 1800Z 12 Dec 03

Last Warning: 1800Z 15 Dec 03, Dissipation

Max Intensity: 55 kts, gusts to 70 kts

Landfall : Near False Divi Point, India

Total Warnings: 7

Remarks:

(1) Tropical Cyclone (TC) 03B formed off the northwest coast of Summatra and tracked northwestward along the periphery of the low to mid-level steering ridge while slowly intensifying. The cyclone reached a peak intensity of 55 knots before making landfall near False Divi Point, India on 15 December, 2003 at approximately 1430Z.

(2) Reports indicate that there were 27 fatalities and more than 5100 homes damaged by heavy flooding and high winds. Uprooted trees and damaged electrical tranformers created extensive power outages in India.

|          |     |       |         | Stati | stic | s f | or J | TWC | on  | TC0 | 3B |     |    |      |    |     |     |     |    |     |
|----------|-----|-------|---------|-------|------|-----|------|-----|-----|-----|----|-----|----|------|----|-----|-----|-----|----|-----|
|          |     |       |         |       |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
|          | WRN | BEST  | TRACK   |       | РО   | SIT | ION  | ERR | ORS |     |    |     | WI | ND E | RR | ROR | S   |     |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12  | 24   | 36  | 48  | 72  | 96 | 120 | 00 | 12   | 24 | 36  | 48  | 72  | 96 | 120 |
| 03121106 |     | 4.5N  | 91.7E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121112 |     | 5.0N  | 90.7E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121118 |     | 5.6N  | 89.8E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121200 |     | 6.4N  | 89.0E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121206 |     | 7.3N  | 88.9E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121212 |     | 7.7N  | 88.7E   | 25    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121218 | 1   | 7.9N  | 88.4E   | 30    | 24   | 47  | 55   | 96  | 151 | 293 |    |     | 0  | 5    | 5  | 0   | 5   | -15 |    |     |
| 03121306 | 2   | 8.4N  | 87.5E   | 30    | 8    | 42  | 109  | 182 | 276 | 458 |    |     | 0  | 0    | -5 | 0   | -10 | 0   |    |     |
| 03121318 | 3   | 9.3N  | 86.1E   | 35    | 21   | 78  | 139  | 223 | 311 |     |    |     | 0  | -5   | 0  | -5  | 10  |     |    |     |
| 03121406 | 4   | 10.8N | 84.7E   | 45    | 11   | 36  | 99   | 150 | 212 |     |    |     | 0  | 5    | 0  | 5   | 10  |     |    |     |
| 03121418 | 5   | 12.4N | 83.2E   | 45    | 29   | 91  | 134  | 189 |     |     |    |     | 0  | -10  | 5  | 25  |     |     |    |     |
| 03121506 | 6   | 14.6N | 81.6E   | 55    | 13   | 37  | 80   |     |     |     |    |     | 0  | 5    | 10 |     |     |     |    |     |
| 03121518 | 7   | 16.6N | 81.1E   | 45    | 12   | 12  |      |     |     |     |    |     | 5  | 0    |    |     |     |     |    |     |
| 03121600 |     | 17.7N | 81.3E   | 35    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
| 03121606 |     | 18.4N | 81.6E   | 30    |      |     |      |     |     |     |    |     |    |      |    |     |     |     |    |     |
|          |     |       | AVERAGE |       | 17   | 49  | 103  | 168 | 238 | 375 |    |     | 1  | 4    | 4  | 7   | 9   | 8   |    |     |

4

5

2

1 0

7

7

3 5 4

4

6 5

-8

2

BIAS

# CASES

7

7 6

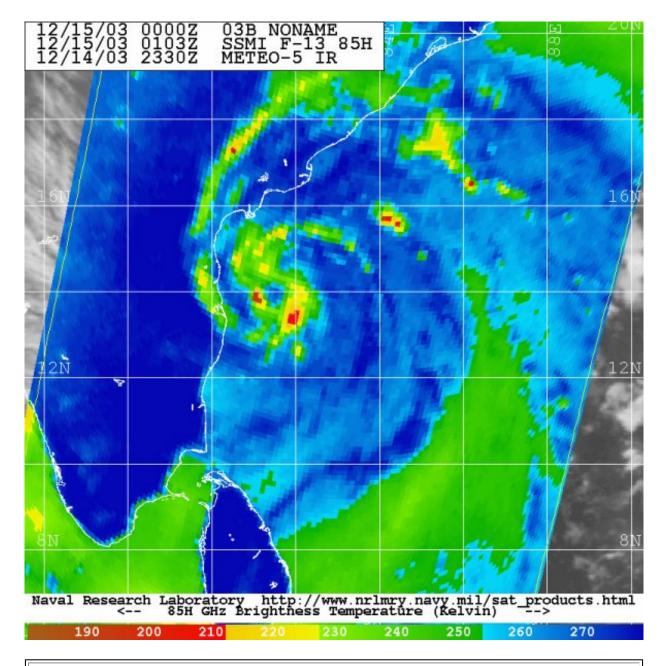


Figure 1-03B-1. 150103Z December 2003 SSM/I imagery of TC 03B, the banding eye was located 115 nm east of the Madras, with an intensity of 50 knots.

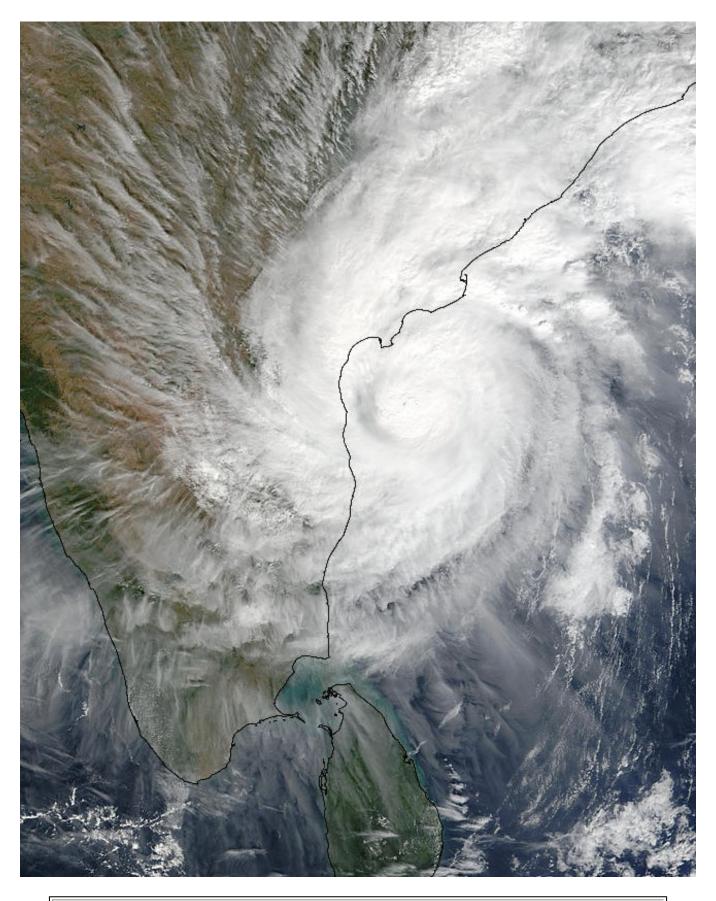
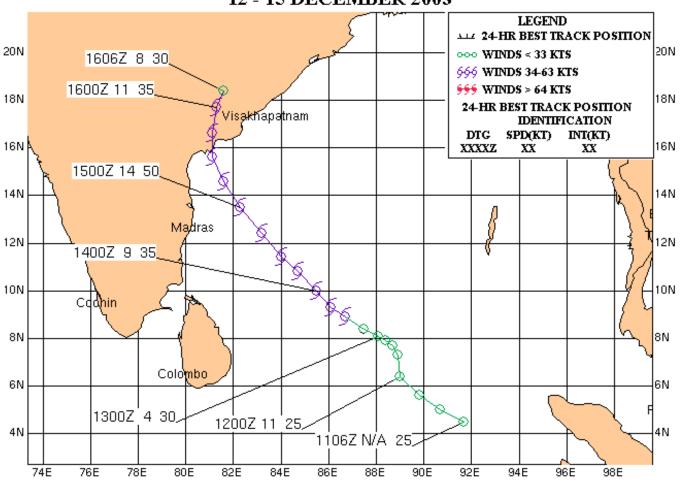


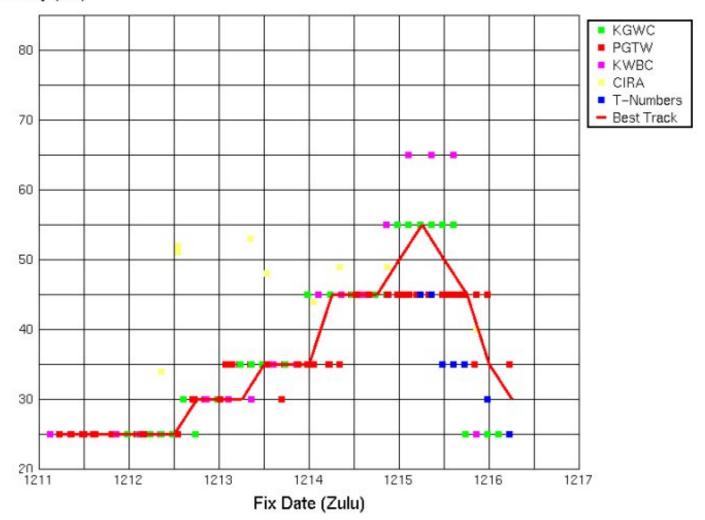
Figure 1-03B-2. 150520Z December 2003 MODIS true-color image of TC 03B, located off the east coast of India, with an intensity of 55 knots.

#### TROPICAL CYCLONE 03B 12 - 15 DECEMBER 2003



# Time Intensity for 03B

#### Intensity (kts)



# 2. SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

#### 2.1 GENERAL

In accordance with CINCPACINST 3140.1 (series), Southern Hemisphere tropical cyclones are numbered sequentially from 01 July through 30 June to reflect the Southern Hemisphere tropical season.

For warning message delineation, the Southern Hemisphere Area of Responsibility (AOR) is divided into two basins: the South Indian (west of 135° East longitude) and the South Pacific Ocean (east of 135° East longitude). The suffixes "S" (South Indian Ocean) and "P" (South Pacific Ocean) are appended to the tropical cyclone number to differentiate warnings for these basins. For this report, the Southern Hemisphere AOR is broken down into three sub-basins, reflecting primary cyclogenesis areas: South Indian (west of 105° East longitude), Australia (105° East longitude to 165° East longitude), and South Pacific (east of 165° East longitude).

#### 2.2 SUMMARY

Table 2-1 lists the significant tropical cyclones during the 2003 season and can be compared to the climatological mean presented in Table 2-2. Table 2-3 compares this year's tropical cyclone activity in the Southern Hemisphere sub-basins to previous years and climatology. Composites of the tropical cyclone best tracks for the Southern Hemisphere appear following Table 2-3.

#### Table 2-1 **SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2003** (01 JULY 2002 - 30 JUNE 2003) **EST MAX SFC WINDS** NUMBER **MSLP** TC NAME **PERIOD ISSUED** (MB)\*\* KTS (M/SEC) 01S Abaimba 06 Sep - 08 Sep 4 35(18) 997 02S 06 Nov - 13 Nov 12 45(23) 991 Atang 22 03S Boura 15 Nov - 22 Nov 75(39) 967 04P Yolande 04 Dec - 05 Dec 2 35(18) 997 05S 12 954 Crystal 23 Dec - 29 Dec 90(46) 06P Zoe 25 Dec - 01 Jan 14 155(80) 879 07S 26 Dec - 28 Dec 5 30(15) 1000 08S Delfina 30 Dec - 01 Jan 4 55(28) 984 09S Ebula 08 Jan - 12 Jan 9 65(33) 976 10P 11 Jan - 15 Jan 9 Ami 110(57) 933 **11S** Fari 23 Jan - 31 Jan 9 55(28) 984 12P Beni 25 Jan - 31 Jan 14 125(64) 916 13P Cilla 27-Jan 2 35(18) 997 **14S** Fiona 05 Feb - 13 Feb 19 110(57) 933 15P Dovi 05 Feb - 10 Feb 11 130(67) 910 **16S** 08 Feb - 15 Feb 15 105(54) 938 Gerry **17S** 10 Feb - 14 Feb 10 963 Hape 80(41) **18S** 7 Isha 11 Feb - 14 Feb 45(23) 991 **19S** 12 **Japhet** 26 Feb - 03 Mar 115(59) 927 20S Graham 27 Feb - 01 Mar 4 40(21) 994 21S Harriet 02 Mar - 09 Mar 21 35(18) 997 22P Erica 910 04 Mar - 15 Mar 18 130(67) **23S** Kalunde 05 Mar - 15 Mar 23 140(72) 898 **24S** 08 Mar - 12 Mar 9 35(18) 997 Craig 25P Eseta 10 Mar - 14 Mar 8 110(57) 933 **26S** Inigo 01 Apr - 08 Apr 23 140(72) 898 27P 1 Fili 14-Apr 45(23) 991 **28S** Manou 03 May - 10 May 16 75(39) 967

| 29P | Gina | 04 Jun - 08 Jun | 10  | 90(46) | 954 |
|-----|------|-----------------|-----|--------|-----|
|     |      |                 |     |        |     |
|     |      |                 |     |        |     |
|     |      | Total           | 325 |        |     |

<sup>\*\*</sup>MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind pressure relationship. Number of warnings issued includes Amended warnings.

| Table 2               | 2-2     |       |      |       |        |       |       |       |      |       |       |       |        |
|-----------------------|---------|-------|------|-------|--------|-------|-------|-------|------|-------|-------|-------|--------|
| DISTRI                | BUTIC   | ON OF | SOUT | н РАС | IFIC A | ND SC | UTH I | NDIAN | OCEA | N TRO | OPICA | L CYC | LONES  |
| FOR 19                | 958 - 2 | 003   |      |       |        |       |       |       |      |       |       |       |        |
| YEAR                  | JUL     | AUG   | SEP  | ОСТ   | NOV    | DEC   | JAN   | FEB   | MAR  | APR   | MAY   | JUN   | TOTALS |
|                       |         |       |      |       |        |       |       |       |      |       |       |       |        |
| 1958-<br>1977<br>AVE* | -       | -     | -    | 0.4   | 1.5    | 3.6   | 6.1   | 5.8   | 4.7  | 2.1   | 0.5   | -     | 24.7   |
|                       |         |       |      |       |        |       |       |       |      |       |       |       |        |
| 1981                  | 0       | 0     | 0    | 1     | 3      | 2     | 6     | 5     | 3    | 3     | 1     | 0     | 24     |
| 1982                  | 1       | 0     | 0    | 1     | 1      | 3     | 9     | 4     | 2    | 3     | 1     | 0     | 25     |
| 1983                  | 1       | 0     | 0    | 1     | 1      | 3     | 5     | 6     | 3    | 5     | 0     | 0     | 25     |
| 1984                  | 1       | 0     | 0    | 1     | 2      | 5     | 5     | 10    | 4    | 2     | 0     | 0     | 30     |
| 1985                  | 0       | 0     | 0    | 0     | 1      | 7     | 9     | 9     | 6    | 3     | 0     | 0     | 35     |
| 1986                  | 0       | 0     | 1    | 0     | 1      | 1     | 9     | 9     | 6    | 4     | 2     | 0     | 33     |
| 1987                  | 0       | 1     | 0    | 0     | 1      | 3     | 6     | 8     | 3    | 4     | 1     | 1     | 28     |
| 1988                  | 0       | 0     | 0    | 0     | 2      | 3     | 5     | 5     | 3    | 1     | 2     | 0     | 21     |

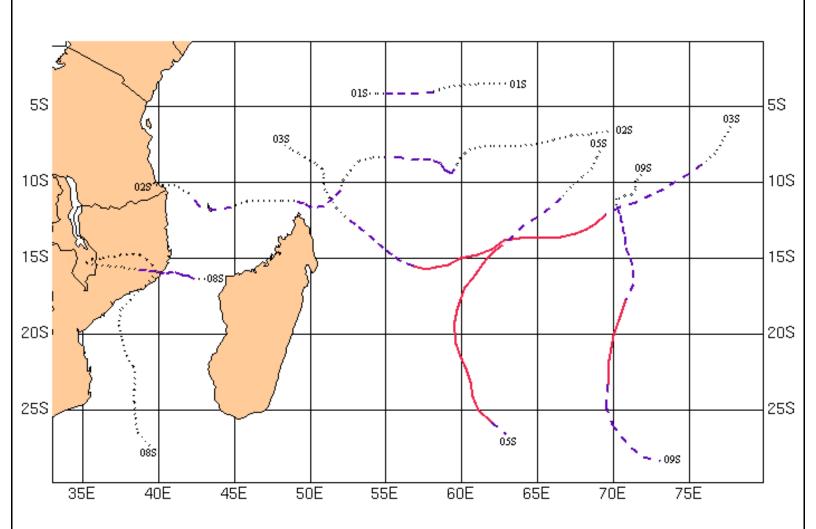
| 1989      | 0      | 0      | 0     | 0      | 2       | 1      | 5   | 8   | 6   | 4   | 2   | 0   | 28   |
|-----------|--------|--------|-------|--------|---------|--------|-----|-----|-----|-----|-----|-----|------|
| 1990      | 2      | 0      | 1     | 1      | 2       | 2      | 4   | 4   | 10  | 2   | 1   | 0   | 29   |
| 1991      | 0      | 0      | 1     | 1      | 1       | 3      | 2   | 5   | 5   | 2   | 1   | 1   | 22   |
| 1992      | 0      | 0      | 1     | 1      | 2       | 5      | 4   | 11  | 3   | 2   | 1   | 0   | 30   |
| 1993      | 0      | 0      | 1     | 1      | 0       | 5      | 7   | 7   | 2   | 2   | 2   | 0   | 27   |
| 1994      | 0      | 0      | 0     | 0      | 2       | 4      | 8   | 4   | 9   | 3   | 0   | 0   | 30   |
| 1995      | 0      | 0      | 0     | 0      | 2       | 2      | 5   | 4   | 5   | 4   | 0   | 0   | 22   |
| 1996      | 0      | 0      | 0     | 0      | 1       | 3      | 7   | 6   | 6   | 4   | 1   | 0   | 28   |
| 1997      | 1      | 1      | 1     | 2      | 2       | 6      | 9   | 8   | 3   | 1   | 3   | 1   | 38   |
| 1998      | 1      | 0      | 0     | 3      | 2       | 3      | 7   | 9   | 6   | 6   | 0   | 0   | 37   |
| 1999      | 1      | 0      | 1     | 1      | 1       | 6      | 6   | 8   | 7   | 2   | 0   | 0   | 33   |
| 2000      | 0      | 0      | 0     | 0      | 0       | 3      | 6   | 5   | 7   | 6   | 0   | 0   | 27   |
| 2001      | 0      | 1      | 0     | 0      | 1       | 1      | 4   | 6   | 2   | 5   | 0   | 1   | 21   |
| 2002      | 0      | 0      | 0     | 2      | 4       | 1      | 4   | 5   | 4   | 2   | 3   | 0   | 25   |
| 2003      | 0      | 0      | 1     | 0      | 2       | 5      | 5   | 7   | 5   | 2   | 1   | 1   | 29   |
| (1981-2   | 003)   | 1      | ,     | ,      | 1       | 1      | ,   | '   | ,   | 1   | '   | 1   | '    |
| MEAN      | 0.3    | 0.1    | 0.3   | 0.7    | 1.6     | 3.3    | 6.0 | 6.7 | 4.8 | 3.1 | 1.0 | 0.2 | 28.1 |
| CASES     | 8      | 3      | 8     | 16     | 36      | 77     | 137 | 153 | 110 | 72  | 22  | 5   | 647  |
| * (GRA)   | , 197  | 78)    |       |        |         |        |     |     | 1   |     |     |     |      |
| The crite | eria u | sed in | TABLE | 2-2 ar | e as fo | llows: |     |     |     |     |     |     |      |

file:///C|/Documents%20and%20Settings/All%20Us...2003%20folder/ATCR\_2003/chapter2/chapter2.html (4 of 12) [4/10/2005 11:21:55 AM]

- 1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
- 2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
- 3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

|                       |                    | Table 2-3                 |                    |          |
|-----------------------|--------------------|---------------------------|--------------------|----------|
| ANNUAI                | L VARIATION O      | F SOUTHERN<br>NES BY OCEA |                    | TROPICAL |
|                       |                    | 1958-2003                 |                    |          |
| YEAR                  | SOUTH INDIAN       | AUSTRALIAN                | SOUTH<br>PACIFIC   |          |
|                       | (WEST OF<br>105°E) | (105°E - 165°E)           | (EAST OF<br>165°E) | TOTAL    |
| 1958-1977<br>AVERAGE* | 8.4                | 10.3                      | 5.9                | 24.6     |
| 1981                  | 13                 | 8                         | 3                  | 24       |
| 1982                  | 12                 | 11                        | 2                  | 25       |
| 1983                  | 7                  | 6                         | 12                 | 25       |
| 1984                  | 14                 | 14                        | 2                  | 30       |
| 1985                  | 14                 | 15                        | 6                  | 35       |
| 1986                  | 14                 | 16                        | 3                  | 33       |
|                       |                    |                           |                    | l        |

| 1987          | 9    | 8   | 11  | 28   |
|---------------|------|-----|-----|------|
| 1988          | 14   | 2   | 5   | 21   |
| 1989          | 12   | 9   | 7   | 28   |
| 1990          | 18   | 8   | 3   | 29   |
| 1991          | 11   | 10  | 1   | 22   |
| 1992          | 11   | 6   | 13  | 30   |
| 1993          | 10   | 16  | 1   | 27   |
| 1994          | 16   | 10  | 4   | 30   |
| 1995          | 11   | 7   | 4   | 22   |
| 1996          | 13   | 11  | 4   | 28   |
| 1997          | 17   | 5   | 16  | 38   |
| 1998          | 12   | 10  | 15  | 37   |
| 1999          | 13   | 16  | 4   | 33   |
| 2000          | 10   | 12  | 5   | 27   |
| 2001          | 10   | 8   | 3   | 21   |
| 2002          | 14   | 7   | 4   | 25   |
| 2003          | 14   | 6   | 9   | 29   |
| (1981-2003)   | 1    | 1   | 1   | 1    |
| TOTAL         | 289  | 221 | 137 | 647  |
| AVERAGE       | 12.6 | 9.6 | 6.0 | 28.1 |
| * (Gray,1978) |      |     |     |      |



SOUTHEAST INDIAN OCEAN TROPICAL CYCLONES 06 NOV 2002 - 12 JAN 2003

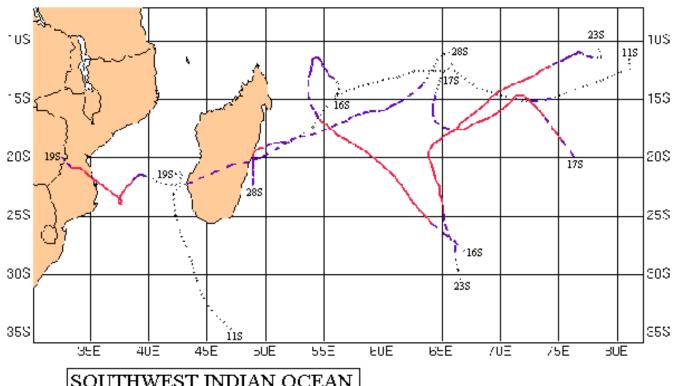
MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER

34 TO 63KT (18 TO 32M/SEC)

33KT (17M/SEC) OR LESS

TC 01S 06 SEP - 08 SEP
TC 02S (ATANG) 06 NOV - 13 NOV
TC 03S (BOURA) 15 NOV - 22 NOV
TC 03S (CRYSTAL) 23 DEC - 29 DEC
TC 08S (DELFINA) 30 DEC - 01 JAN
TC 09S (EBULA) 08 JAN - 12 JAN



SOUTHWEST INDIAN OCEAN TROPICAL CYCLONES 23 JAN 2003 - 10 MAY 2003

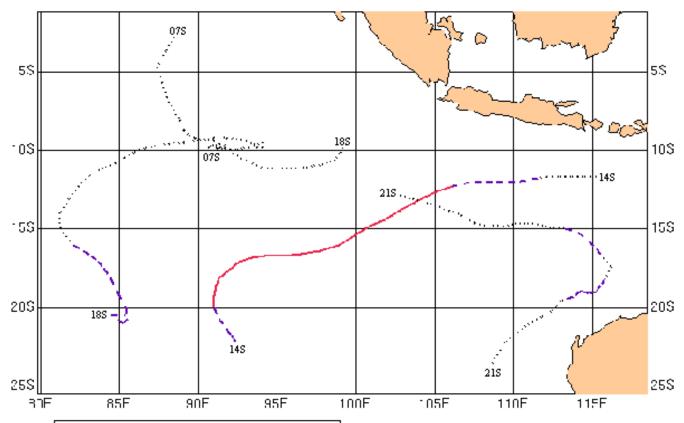
MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER

34 TO 63KT (18 TO 32M/SEC)

33KT (17M/SEC) OR LESS

TC 11S (FARI) 23 JAN - 31 JAN
TC 16S (GERRY) 08 FEB - 14 FEB
TC 17S (HAPE) 10 FEB - 14 FEB
TC 19S (JAPHET) 14 FEB - 03 MAR
TC 23S (KALUNDE) 05 MAR - 15 MAR
TC 28S (MANOU) 03 MAY - 10 MAY



SOUTHEAST INDIAN OCEAN TROPICAL CYCLONES 26 DEC 2002 - 09 MAR 2003

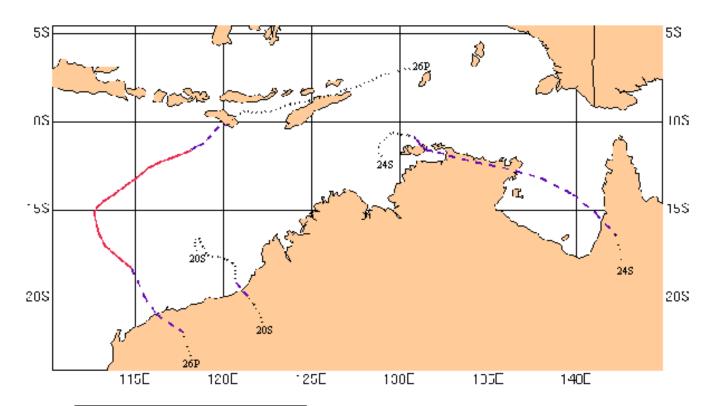
TC 07S 26 DEC - 28 DEC TC 14S (FIONA) 05 FEB - 13 FEB TC 18S (ISHA) 11 FEB - 14 FEB TC 21S (HARRIET) 02 MAR - 09 MAR

MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER

34 TO 63KT (18 TO 32M/SEC)

33KT (17M/SEC) OR LESS



AUSTRALIA REGION TROPCIAL CYCLONES 27 FEB - 08 APR 2003

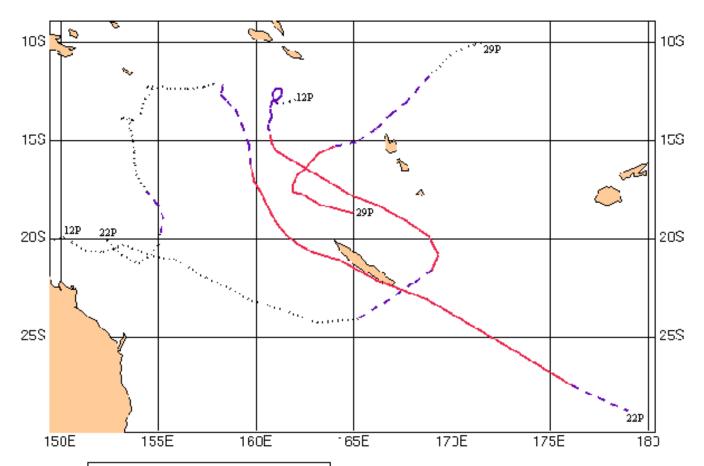
MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER

34 TO 63KT (18 TO 32M/SEC)

33KT (17M/SEC) OR LESS

TC 20S (GRAHAM) 27 FEB - 01 MAR 2003 TC 24S (CRAIG) 08 MAR - 12 MAR 2003 TC 26P (INIGO) 01 APR - 08 APR 2003

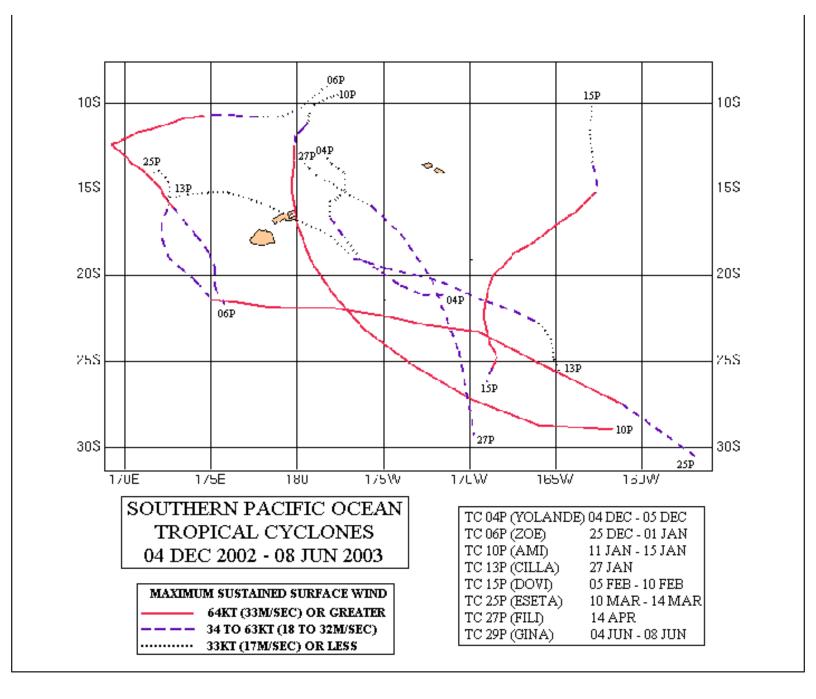


AUSTRALIA REGION TROPICAL CYCLONES 25 JAN 2003- 08 JUN 2003

MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS

TC 12P (BENI) 25 JAN - 31 JAN TC 22P (ERICA) 04 MAR - 15 MAR TC 29P (GINA) 04 JUN - 08 JUN



## **Tropical Cyclone (TC) 01S**



First Poor: N/A

First Fair: 1500Z 05 Sep 02

First TCFA: N/A

First Warning: 1800Z 06 Sep 02

Last Warning: 0600Z 08 Sep 02, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 4

#### Remarks:

(1) Tropical Cyclone (TC) 01S developed in a near-equatorial trough at approximately 5 September, 2002, approximately 650 NM west-northwest of Diego Garcia. The cyclone tracked westward over the next 3 days as a weak system that intensified to only 35 knots. No operational impacts and no damage reported.

\*Named by WMO designated RSMC

# Statistics for JTWC on TC01S

|     | WRN | BEST | TRACK |      | РО | SITI | ON | ERI | ROF | RS |    |     | WII | ND E | ERR | OR | S  |    |    |     |
|-----|-----|------|-------|------|----|------|----|-----|-----|----|----|-----|-----|------|-----|----|----|----|----|-----|
| DTG | NO. | LAT  | LONG  | wind | 00 | 12   | 24 | 36  | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36 | 48 | 72 | 96 | 120 |

|          | , | ,    | ,       |    |    |    |    |    | <br> |  |   |   |   |   | <br> | <br> |
|----------|---|------|---------|----|----|----|----|----|------|--|---|---|---|---|------|------|
| 02090512 |   | 3.5S | 62.9E   | 20 |    |    |    |    |      |  |   |   |   |   |      |      |
| 02090518 |   | 3.5S | 61.9E   | 20 |    |    |    |    |      |  |   |   |   |   |      |      |
| 02090600 |   | 3.5S | 60.9E   | 20 |    |    |    |    |      |  |   |   |   |   |      |      |
| 02090606 |   | 3.6S | 59.9E   | 20 |    |    |    |    |      |  |   |   |   |   |      |      |
| 02090612 |   | 3.7S | 58.9E   | 25 |    |    |    |    |      |  |   |   |   |   |      |      |
| 02090618 | 1 | 4.0S | 58.1E   | 35 | 11 | 6  | 30 | 73 |      |  | 0 | 0 | 0 | 0 |      |      |
| 02090706 | 2 | 4.2S | 56.3E   | 35 | 11 | 18 | 68 |    |      |  | 0 | 0 | 0 |   |      |      |
| 02090718 | 3 | 4.2S | 54.9E   | 30 | 11 | 24 |    |    |      |  | 0 | 0 |   |   |      |      |
| 02090806 | 4 | 4.2S | 53.9E   | 25 | 8  |    |    |    |      |  | 5 |   |   |   |      |      |
|          |   |      | AVERAGE |    | 11 | 16 | 49 | 73 |      |  | 1 | 0 | 0 | 0 |      |      |
|          |   |      | BIAS    |    |    |    |    |    |      |  | 1 | 0 | 0 | 0 |      |      |
|          |   |      | # CASES |    | 4  | 3  | 2  | 1  |      |  | 4 | 3 | 2 | 1 |      |      |

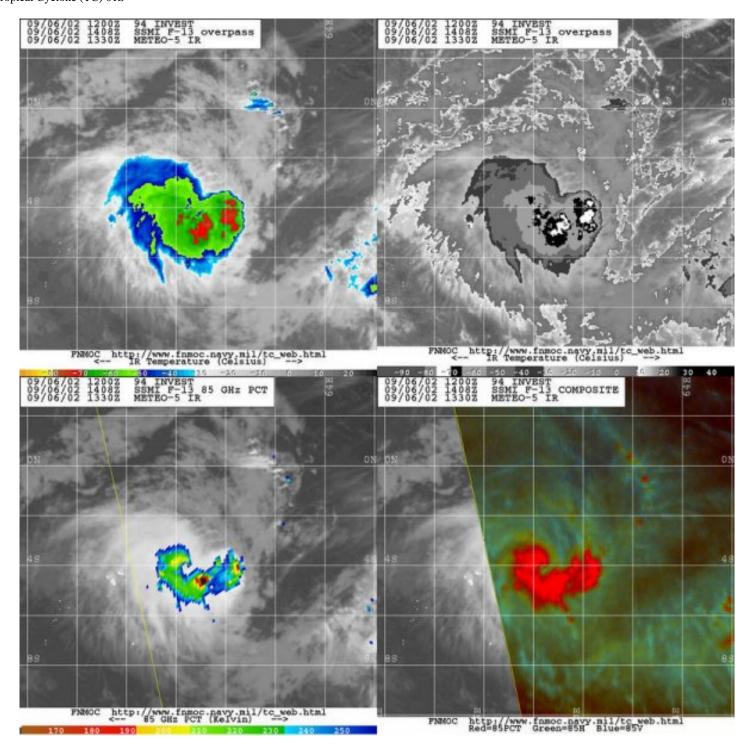
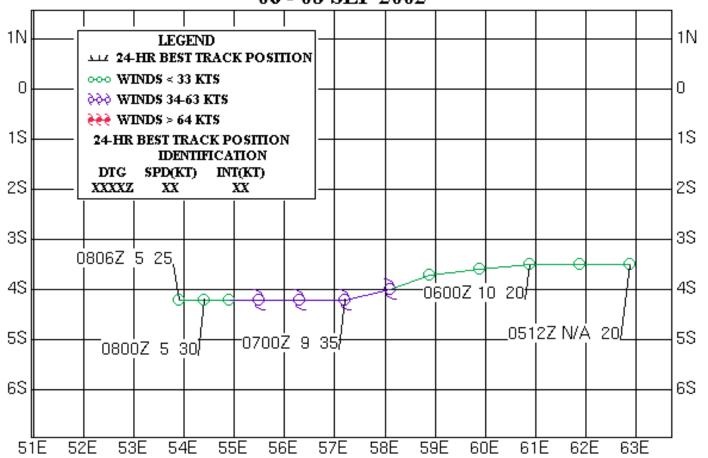
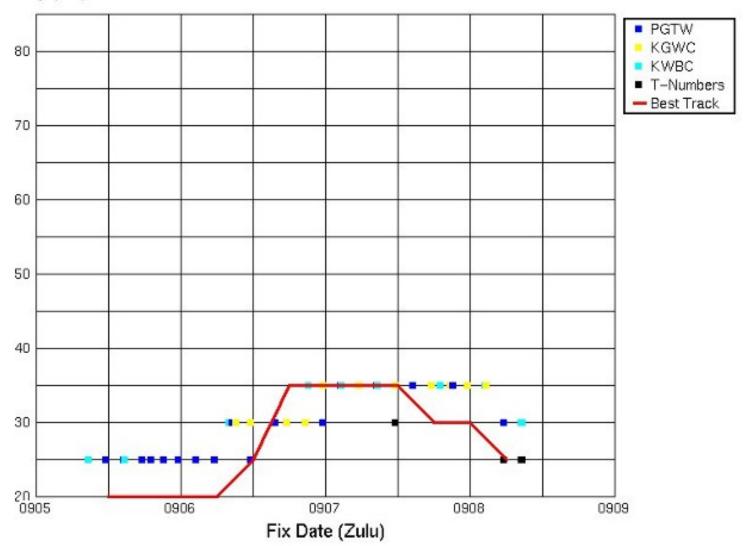


Figure 2-01S-1. 061408Z September 2003 multi-sensor satellite images of TC 01S, located 855 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

#### TROPICAL CYCLONE 01S 06 - 08 SEP 2002



# Time Intensity for 01S



### **Tropical Cyclone (TC) 01S**



First Poor: N/A

First Fair : 1500Z 05 Sep 02

First TCFA: N/A

First Warning: 1800Z 06 Sep 02

Last Warning: 0600Z 08 Sep 02, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 4

#### Remarks:

(1) Tropical Cyclone (TC) 01S developed in a near-equatorial trough at approximately 5 September, 2002, approximately 650 NM west-northwest of Diego Garcia. The cyclone tracked westward over the next 3 days as a weak system that intensified to only 35 knots. No operational impacts and no damage reported.

|          |     |      | S       | tatist | ics | for | JT۱ | NC  | on  | TC | 01S |     |     |      |     |    |    |    |    |     |
|----------|-----|------|---------|--------|-----|-----|-----|-----|-----|----|-----|-----|-----|------|-----|----|----|----|----|-----|
|          | ,   |      |         |        |     |     |     |     |     |    |     |     | ,   |      |     |    |    |    |    |     |
|          | WRN | BEST | TRACK   |        | PO  | SIT | ION | ERI | ROF | RS |     |     | WII | ND I | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT  | LONG    | wind   | 00  | 12  | 24  | 36  | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36 | 48 | 72 | 96 | 120 |
| 02090512 |     | 3.5S | 62.9E   | 20     |     |     |     |     |     |    |     |     |     |      |     |    |    |    |    |     |
| 02090518 |     | 3.5S | 61.9E   | 20     |     |     |     |     |     |    |     |     |     |      |     |    |    |    |    |     |
| 02090600 |     | 3.5S | 60.9E   | 20     |     |     |     |     |     |    |     |     |     |      |     |    |    |    |    |     |
| 02090606 |     | 3.6S | 59.9E   | 20     |     |     |     |     |     |    |     |     |     |      |     |    |    |    |    |     |
| 02090612 |     | 3.7S | 58.9E   | 25     |     |     |     |     |     |    |     |     |     |      |     |    |    |    |    |     |
| 02090618 | 1   | 4.0S | 58.1E   | 35     | 11  | 6   | 30  | 73  |     |    |     |     | 0   | 0    | 0   | 0  |    |    |    |     |
| 02090706 | 2   | 4.2S | 56.3E   | 35     | 11  | 18  | 68  |     |     |    |     |     | 0   | 0    | 0   |    |    |    |    |     |
| 02090718 | 3   | 4.2S | 54.9E   | 30     | 11  | 24  |     |     |     |    |     |     | 0   | 0    |     |    |    |    |    |     |
| 02090806 | 4   | 4.2S | 53.9E   | 25     | 8   |     |     |     |     |    |     |     | 5   |      |     |    |    |    |    |     |
|          |     |      | AVERAGE |        | 11  | 16  | 49  | 73  |     |    |     |     | 1   | 0    | 0   | 0  |    |    |    |     |
|          |     |      | BIAS    |        |     |     |     |     |     |    |     |     | 1   | 0    | 0   | 0  |    |    |    |     |
|          |     |      | # CASES |        | 4   | 3   | 2   | 1   |     |    |     |     | 4   | 3    | 2   | 1  |    |    |    |     |

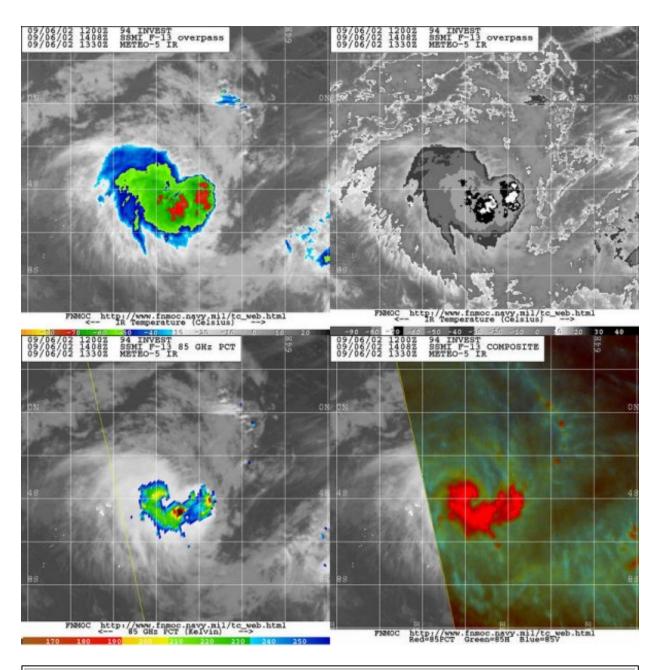
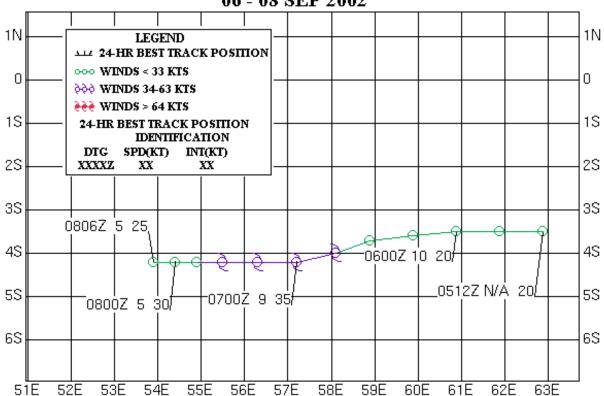
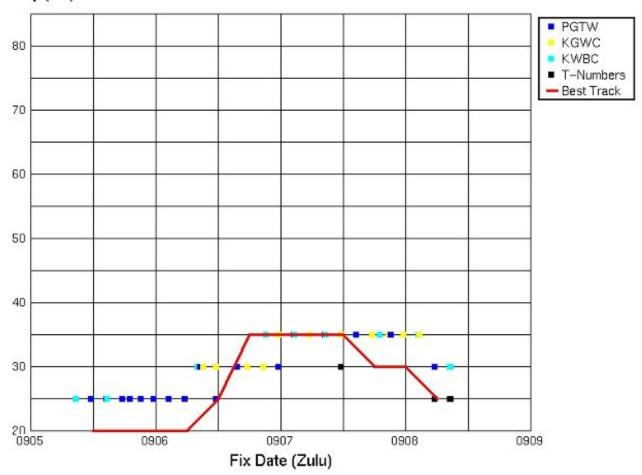


Figure 2-01S-1. 061408Z September 2003 multi-sensor satellite images of TC 01S, located 855 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

#### TROPICAL CYCLONE 01S 06 - 08 SEP 2002



## Time Intensity for 01S



## Tropical Cyclone (TC) 02S (Atang)\*



First Poor: 1100Z 03 Nov 02

First Fair: 1800Z 03 Nov 02

First TCFA: 2100Z 03 Nov 02

First Warning: 0600Z 06 Nov 02

Last Warning: 0000Z 13 Nov 02, Dissipated

Max Intensity: 45 kts, gusts to 55 kts

Landfall: Southeastern coast of Tanzania

Total Warnings: 12

Remarks:

- (1) Tropical Cyclone (TC) 02S initially developed approximately 1,150 NM east-northeast of the northern tip of Madagascar. The system reached a maximum intensity of 45 kts on 06 November at 1800Z. A final warning was issued for TC 02S on 07 November and then the TC regenerated back into warning status on 09 November at 0600Z. The cyclone was finaled a second time on 10 November at 1800Z when the system was located approximately 50 NM northwest of Madagascar. The cyclone regenerated again as it entered into the warmer waters of the Mozambique Channel and was subsequently finaled on 13 November at 0000Z.
- (2) TC 02S made landfall on the southeastern coast of Tanzania, however no reports of damage were available.

### Statistics for JTWC on TC02S

|          | WRN  | BES   | T TRACK        |      |    | D   | <u> </u> | TION! | ERR | ΛP | <u> </u> |     |    |     | ۱۸/۱۱ | UD E | RRC | 100 |    |     |
|----------|------|-------|----------------|------|----|-----|----------|-------|-----|----|----------|-----|----|-----|-------|------|-----|-----|----|-----|
| DTG      | NO.  | LAT   | LONG           | wind | 00 | 12  | 24       | 36    |     |    |          | 120 | 00 |     | 24    |      |     |     |    | 120 |
| 02110306 | INO. | 6.6S  | 69.6E          | 15   | 00 | 12  | 24       | 30    | 40  | 12 | 90       | 120 | 00 | 12  | 24    | 30   | 40  | 12  | 90 | 120 |
| 02110308 |      | 6.8S  | 68.4E          | 15   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    | ,   |
|          |      |       |                |      |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110318 |      | 6.9S  | 67.2E          | 20   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110400 |      | 7.2S  | 66.0E<br>64.6E | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110406 |      | 7.5S  |                | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110412 |      | 7.6S  | 63.3E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110418 |      | 7.6S  | 62.0E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110500 |      | 7.6S  | 61.2E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110506 |      | 7.8S  | 60.6E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110512 |      | 8.1S  | 60.2E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110518 |      | 8.4S  | 59.9E          | 25   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110600 |      | 8.8S  | 59.7E          | 30   |    |     |          |       |     |    |          |     |    |     |       |      |     |     |    |     |
| 02110606 | 1    | 9.1S  | 59.5E          | 35   | 29 | 62  | 121      | 126   | 133 |    |          |     | 0  | -10 | 0     | 5    | 15  |     |    |     |
| 02110618 | 2    | 9.2S  | 58.9E          | 45   | 37 | 102 | 114      | 121   | 72  |    |          |     | 0  | 20  | 20    | 30   | 30  |     |    |     |
| 02110706 | 3    | 8.5S  | 58.0E          | 35   | 47 | 109 | 176      | 178   | 136 |    |          |     | 0  | 5   | 15    | 15   | 0   |     |    |     |
| 02110718 | 4    | 8.4S  | 56.1E          | 35   | 0  | 43  |          |       |     |    |          |     | 0  | 5   |       |      |     |     |    |     |
| 02110906 | 5    | 10.5S | 52.0E          | 35   | 29 | 48  | 45       | 65    | 130 |    |          |     | 0  | 0   | 0     | 15   | 5   |     |    |     |
| 02110918 | 6    | 11.5S | 50.9E          | 35   | 34 | 134 | 201      | 208   | 172 |    |          |     | 0  | -10 | 5     | -5   | -10 |     |    |     |
| 02111006 | 7    | 11.4S | 49.6E          | 35   | 42 | 108 | 161      | 152   | 223 |    |          |     | 0  | 10  | -5    | -10  | -5  |     |    |     |
| 02111018 | 8    | 11.2S | 48.1E          | 20   | 47 | 113 |          |       |     |    |          |     | 0  | -15 |       |      |     |     |    |     |
| 02111112 | 9    | 11.6S | 44.8E          | 35   | 17 | 38  | 129      | 151   |     |    |          |     | 0  | -5  | -5    | -5   |     |     |    |     |
| 02111200 | 10   | 11.5S | 42.7E          | 35   | 18 | 108 | 104      |       |     |    |          |     | 0  | 0   | -5    |      |     |     |    |     |
| 02111212 | 11   | 10.2S | 41.1E          | 30   | 21 | 70  |          |       |     |    |          |     | 5  | 5   |       |      |     |     |    |     |
| 02111300 | 12   | 10.2S | 39.4E          | 25   | 11 |     |          |       |     |    |          |     | 0  |     |       |      |     |     |    |     |
|          |      |       | AVERAGE        |      | 28 | 85  | 132      | 143   | 144 |    |          |     | 0  | 8   | 7     | 12   | 11  |     |    |     |
|          |      |       | BIAS           |      |    |     |          |       |     |    |          |     | 0  | 0   | 3     | 6    | 6   |     |    |     |
|          |      |       | # CASE         |      | 12 | 11  | 8        | 7     | 6   |    |          |     | 12 | 11  | 8     | 7    | 6   |     |    |     |

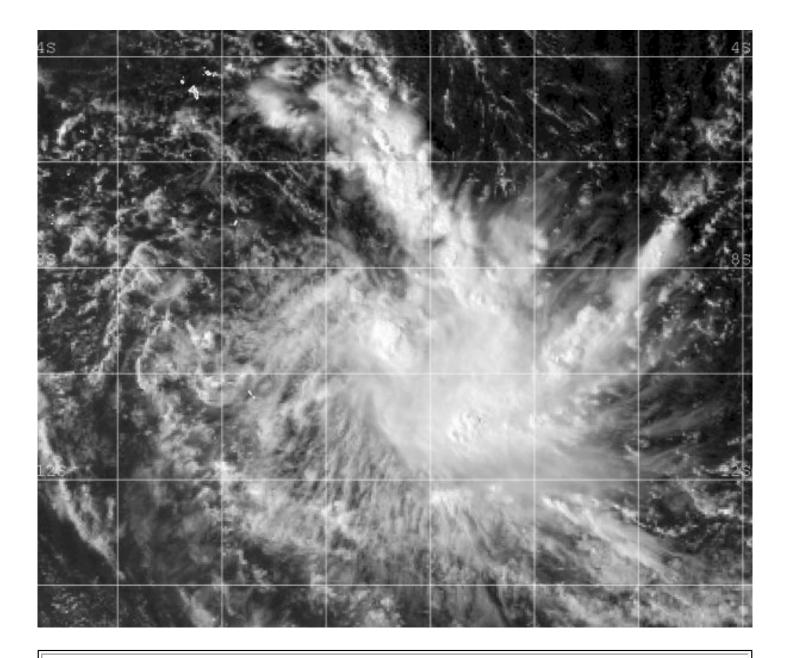


Figure 2-02S-1. 061200Z November 2002 met-5 visible satellite image of TC 02S (Atang), 705 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

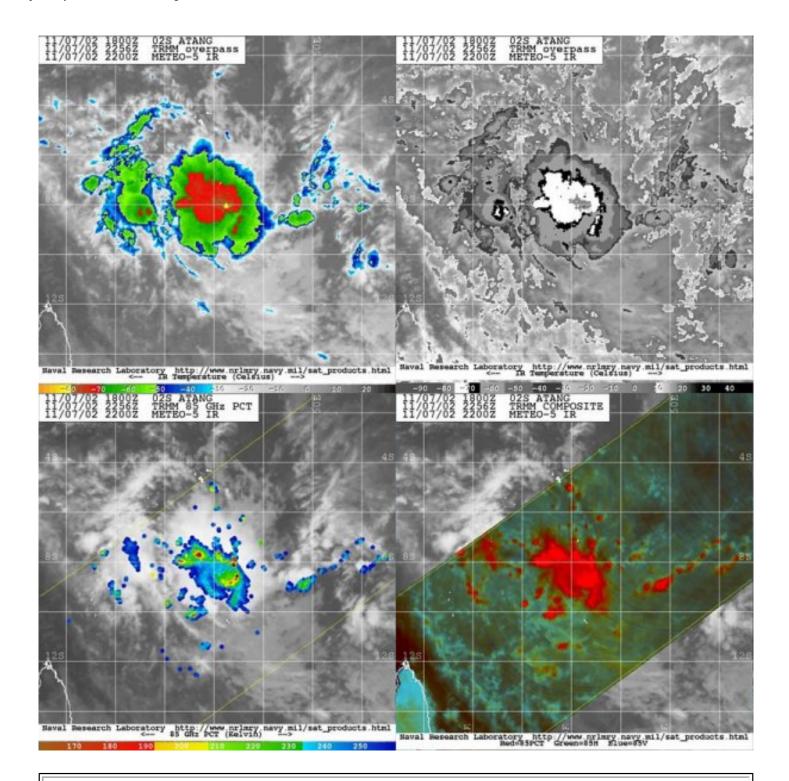
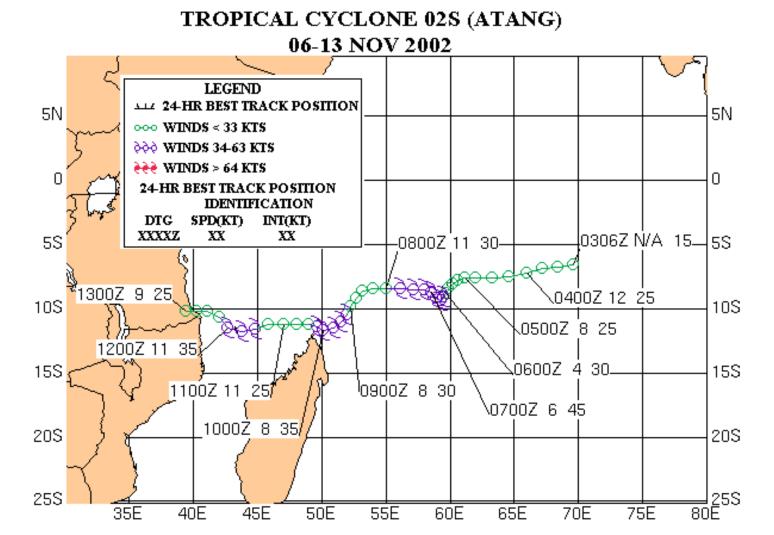
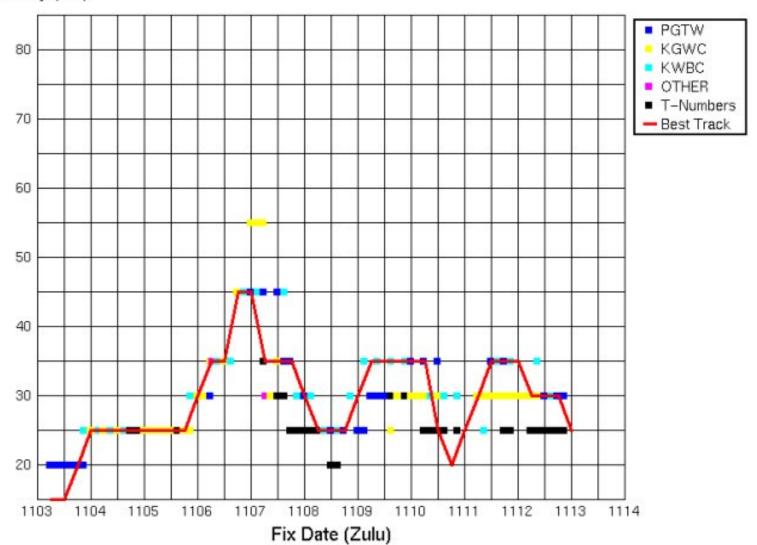


Figure 2-02S-2. 072256Z November 2002 multi-sensor satellite images of TC 02S (Atang), 975 nm west of Diego Garcia, with an estimated intensity of 45 knots.



## Time Intensity for 02S



## **Tropical Cyclone (TC) 02S (Atang)\***



First Poor: 1100Z 03 Nov 02

First Fair: 1800Z 03 Nov 02

First TCFA: 2100Z 03 Nov 02

First Warning: 0600Z 06 Nov 02

Last Warning: 0000Z 13 Nov 02, Dissipated

Max Intensity: 45 kts, gusts to 55 kts

Landfall: Southeastern coast of Tanzania

Total Warnings: 12

Remarks:

- (1) Tropical Cyclone (TC) 02S initially developed approximately 1,150 NM east-northeast of the northern tip of Madagascar. The system reached a maximum intensity of 45 kts on 06 November at 1800Z. A final warning was issued for TC 02S on 07 November and then the TC regenerated back into warning status on 09 November at 0600Z. The cyclone was finaled a second time on 10 November at 1800Z when the system was located approximately 50 NM northwest of Madagascar. The cyclone regenerated again as it entered into the warmer waters of the Mozambique Channel and was subsequently finaled on 13 November at 0000Z.
- (2) TC 02S made landfall on the southeastern coast of Tanzania, however no reports of damage were available.

#### **Statistics for JTWC on TC02S**

|          | WRN | BES   | T TRACK |      |    | P   | OSIT | TION | ERR | OR | S  |     |    |     | WII | ND E | RRC | DRS | 3  |     |
|----------|-----|-------|---------|------|----|-----|------|------|-----|----|----|-----|----|-----|-----|------|-----|-----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24   | 36   | 48  | 72 | 96 | 120 | 00 | 12  | 24  | 36   | 48  | 72  | 96 | 120 |
| 02110306 |     | 6.6S  | 69.6E   | 15   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110312 |     | 6.8S  | 68.4E   | 15   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110318 |     | 6.9S  | 67.2E   | 20   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110400 |     | 7.2S  | 66.0E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110406 |     | 7.5S  | 64.6E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110412 |     | 7.6S  | 63.3E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110418 |     | 7.6S  | 62.0E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110500 |     | 7.6S  | 61.2E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110506 |     | 7.8S  | 60.6E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110512 |     | 8.1S  | 60.2E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110518 |     | 8.4S  | 59.9E   | 25   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110600 |     | 8.8S  | 59.7E   | 30   |    |     |      |      |     |    |    |     |    |     |     |      |     |     |    |     |
| 02110606 | 1   | 9.1S  | 59.5E   | 35   | 29 | 62  | 121  | 126  | 133 |    |    |     | 0  | -10 | 0   | 5    | 15  |     |    |     |
| 02110618 | 2   | 9.2S  | 58.9E   | 45   | 37 | 102 | 114  | 121  | 72  |    |    |     | 0  | 20  | 20  | 30   | 30  |     |    |     |
| 02110706 | 3   | 8.5S  | 58.0E   | 35   | 47 | 109 | 176  | 178  | 136 |    |    |     | 0  | 5   | 15  | 15   | 0   |     |    |     |
| 02110718 | 4   | 8.4S  | 56.1E   | 35   | 0  | 43  |      |      |     |    |    |     | 0  | 5   |     |      |     |     |    |     |
| 02110906 | 5   | 10.5S | 52.0E   | 35   | 29 | 48  | 45   | 65   | 130 |    |    |     | 0  | 0   | 0   | 15   | 5   |     |    |     |
| 02110918 | 6   | 11.5S | 50.9E   | 35   | 34 | 134 | 201  | 208  | 172 |    |    |     | 0  | -10 | 5   | -5   | -10 |     |    |     |
| 02111006 | 7   | 11.4S | 49.6E   | 35   | 42 | 108 | 161  | 152  | 223 |    |    |     | 0  | 10  | -5  | -10  | -5  |     |    |     |
| 02111018 | 8   | 11.2S | 48.1E   | 20   | 47 | 113 |      |      |     |    |    |     | 0  | -15 |     |      |     |     |    |     |
| 02111112 | 9   | 11.6S | 44.8E   | 35   | 17 | 38  | 129  | 151  |     |    |    |     | 0  | -5  | -5  | -5   |     |     |    |     |
| 02111200 | 10  | 11.5S | 42.7E   | 35   | 18 | 108 | 104  |      |     |    |    |     | 0  | 0   | -5  |      |     |     |    |     |
| 02111212 | 11  | 10.2S | 41.1E   | 30   | 21 | 70  |      |      |     |    |    |     | 5  | 5   |     |      |     |     |    |     |
| 02111300 | 12  | 10.2S | 39.4E   | 25   | 11 |     |      |      |     |    |    |     | 0  |     |     |      |     |     |    |     |
|          |     |       | AVERAGE |      | 28 | 85  | 132  | 143  | 144 |    |    |     | 0  | 8   | 7   | 12   | 11  |     |    |     |
|          |     |       | BIAS    |      |    |     |      |      |     |    |    |     | 0  | 0   | 3   | 6    | 6   |     |    |     |
|          |     |       | # CASE  |      | 12 | 11  | 8    | 7    | 6   |    |    |     | 12 | 11  | 8   | 7    | 6   |     |    |     |

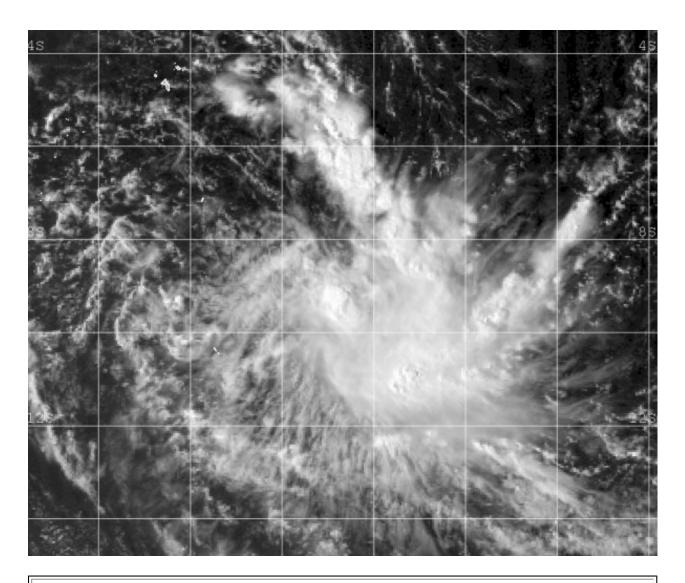


Figure 2-02S-1. 061200Z November 2002 met-5 visible satellite image of TC 02S (Atang), 705 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

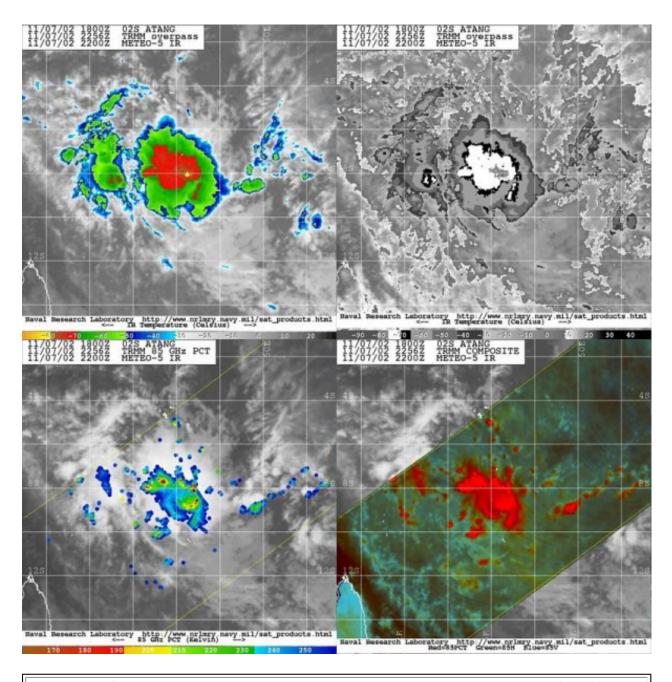
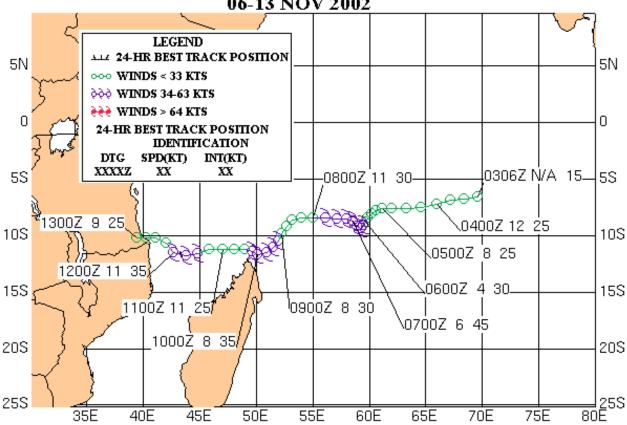
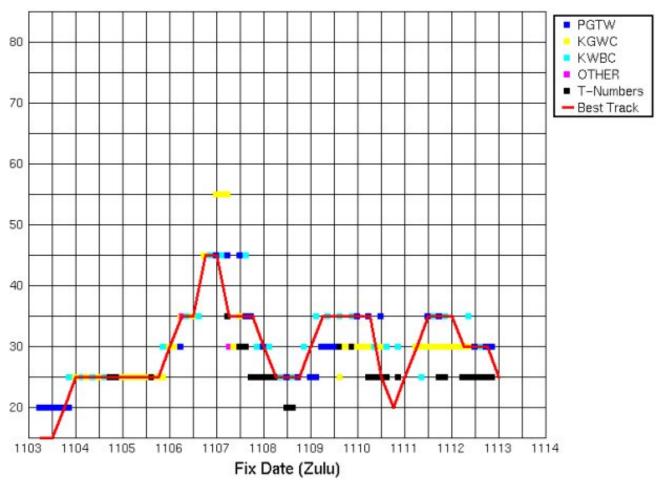


Figure 2-02S-2. 072256Z November 2002 multi-sensor satellite images of TC 02S (Atang), 975 nm west of Diego Garcia, with an estimated intensity of 45 knots.

#### TROPICAL CYCLONE 02S (ATANG) 06-13 NOV 2002



## Time Intensity for 02S



## Tropical Cyclone (TC) 03S (Boura)\*



First Poor: 1800Z 14 Nov 02

First Fair: 2300Z 14 Nov 02

First TCFA: 0830Z 15 Nov 02

First Warning: 1200Z 15 Nov 02

Last Warning: 0000Z 22 Nov 02, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: None

Total Warnings: 22

Remarks:

- (1) Tropical Cyclone (TC) 03S was first noted as a tropical disturbance on 14 November 2002, as it developed in conjunction with an equatorial westerly wind-burst. TC 03S became a significant tropical cyclone approximately 205 nm east-southeast of Diego Garcia. TC 03S tracked southwestward towards Mauritius until 20 November at 18Z under the steering influence of a midlevel subtropical ridge to the southeast. Subsequently, a migatory high moving eastward off of Madagascar caused the cyclone to move northwest until it dissipated under strong vertical wind shear. The remnant low level circulation center to tracked north of Madagascar and dissipated.
- (2) No damage was reported for this system.

## Statistics for JTWC on TC03S

|          | WRN | BEST  | TRACK |      | PO | SIT | ION | ERR | ORS |     |    |     | WIN | ID E | RRC | DRS |     |     |    |     |
|----------|-----|-------|-------|------|----|-----|-----|-----|-----|-----|----|-----|-----|------|-----|-----|-----|-----|----|-----|
| DTG      | NO. | LAT   | LONG  | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 02111418 |     | 6.3S  | 77.7E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111500 |     | 7.2S  | 77.2E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111506 |     | 8.1S  | 76.7E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111512 | 1   | 8.8S  | 75.8E | 35   | 13 | 17  | 32  | 94  | 141 | 276 |    |     | 0   | 0    | -5  | -10 | -15 | -20 |    |     |
| 02111518 | 2   | 9.4S  | 75.0E | 40   | 11 | 43  | 99  | 169 | 187 | 281 |    |     | 0   | 5    | 5   | -10 | -20 | -15 |    |     |
| 02111600 | 3   | 9.9S  | 74.1E | 40   | 25 | 34  | 88  | 132 | 144 | 231 |    |     | 0   | 0    | -5  | -15 | -25 | -15 |    |     |
| 02111606 | 4   | 10.4S | 73.3E | 40   | 5  | 42  | 77  | 89  | 106 | 151 |    |     | 0   | 0    | -15 | -25 | -20 | -15 |    |     |
| 02111612 | 5   | 10.8S | 72.5E | 45   | 0  | 42  | 51  | 42  | 72  | 153 |    |     | 0   | -5   | -10 | -15 | -10 | -10 |    |     |
| 02111618 | 6   | 11.3S | 71.5E | 45   | 39 | 63  | 59  | 69  | 72  | 152 |    |     | 0   | -15  | -20 | -15 | -10 | -15 |    |     |
| 02111700 | 7   | 11.6S | 70.4E | 55   | 67 | 77  | 64  | 88  | 71  | 159 |    |     | -5  | -10  | -15 | -10 | -10 | -15 |    |     |
| 02111706 | 8   | 12.15 | 69.5E | 65   | 5  | 24  | 26  | 70  | 59  | 112 |    |     | 0   | -5   | 0   | 0   | 0   | 5   |    |     |
| 02111712 | 9   | 12.7S | 68.8E | 65   | 0  | 36  | 23  | 47  | 49  | 116 |    |     | 0   | -5   | 0   | 0   | -5  | -10 |    |     |
| 02111718 | 10  | 13.1S | 68.2E | 75   | 11 | 42  | 59  | 67  | 27  | 103 |    |     | 0   | 5    | 5   | 5   | 0   | 10  |    |     |
| 02111800 | 11  | 13.45 | 67.5E | 75   | 12 | 44  | 54  | 31  | 43  | 117 |    |     | 0   | 5    | 0   | -5  | -5  | 15  |    |     |
| 02111806 | 12  | 13.6S | 66.5E | 75   | 11 | 13  | 18  | 75  | 96  | 97  |    |     | 0   | 0    | 0   | -5  | 5   | 20  |    |     |
| 02111812 | 13  | 13.7S | 65.5E | 75   | 6  | 25  | 37  | 48  | 83  | 65  |    |     | 0   | -5   | -5  | -10 | -10 | 20  |    |     |
| 02111818 | 14  | 13.7S | 64.7E | 75   | 0  | 12  | 64  | 104 | 139 | 164 |    |     | 0   | -5   | -5  | 0   | 0   | 25  |    |     |
| 02111900 | 15  | 13.7S | 63.8E | 75   | 5  | 36  | 68  | 112 | 137 | 147 |    |     | 0   | -5   | -5  | -10 | 10  | 25  |    |     |
| 02111906 | 16  | 13.8S | 62.8E | 75   | 6  | 61  | 92  | 122 | 106 | 101 |    |     | 0   | 0    | 5   | 0   | 20  | 25  |    |     |
| 02111912 | 17  | 14.4S | 62.0E | 75   | 5  | 13  | 42  | 63  | 76  | 88  |    |     | 0   | -5   | -5  | 15  | 20  | 25  |    |     |
| 02112000 | 18  | 15.0S | 59.9E | 75   | 6  | 54  | 76  | 83  | 89  |     |    |     | 0   | -5   | 15  | 25  | 30  |     |    |     |
| 02112012 | 19  | 15.6S | 58.3E | 75   | 23 | 37  | 63  | 78  | 97  |     |    |     | -10 | 5    | 10  | 15  | 10  |     |    |     |
| 02112100 | 20  | 15.5S | 56.8E | 55   | 30 | 78  | 126 | 168 | 216 |     |    |     | 10  | 15   | 20  | 15  | 20  |     |    |     |
| 02112112 | 21  | 14.8S | 55.4E | 45   | 0  | 19  | 51  | 86  | 158 |     |    |     | 0   | 0    | 0   | 0   | 0   |     |    |     |
| 02112200 | 22  | 13.8S | 54.2E | 35   | 18 | 27  |     |     |     |     |    |     | 0   | -5   |     |     |     |     |    |     |
| 02112206 |     | 13.2S | 53.6E | 35   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112212 |     | 12.8S | 53.0E | 35   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112218 |     | 12.3S | 52.3E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112300 |     | 11.7S | 51.7E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112306 |     |       | 51.3E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112312 |     | 10.5S | 51.0E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |

| 02112318 | 10.1S | 50.9E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
|----------|-------|---------|----|----|----|----|----|-----|-----|--|----|----|----|----|----|----|--|
| 02112400 | 9.5S  | 50.9E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112406 | 9.1S  | 50.8E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112412 | 8.7S  | 50.3E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112418 | 8.4S  | 49.7E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112500 | 8.1S  | 49.2E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112506 | 7.8S  | 48.7E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112512 | 7.5S  | 48.3E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
|          |       | AVERAGE |    | 14 | 38 | 61 | 88 | 103 | 148 |  | 1  | 5  | 7  | 10 | 12 | 17 |  |
|          |       | BIAS    |    |    |    |    |    |     |     |  | 0  | -2 | -1 | -3 | -1 | 3  |  |
|          |       | # CASE  |    | 22 | 22 | 21 | 21 | 21  | 17  |  | 22 | 22 | 21 | 21 | 21 | 17 |  |

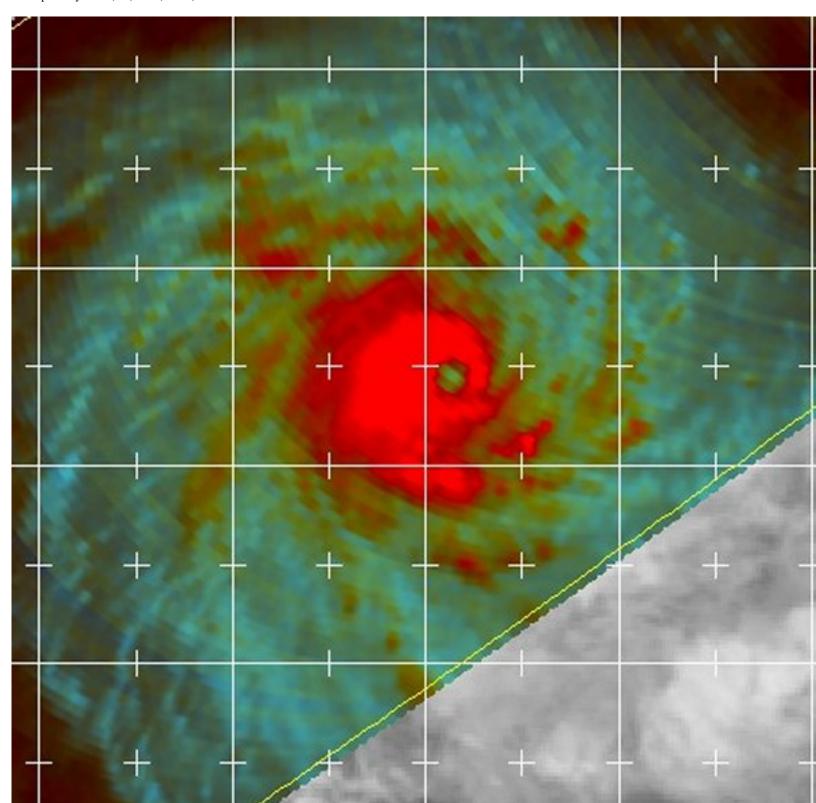


Figure 2-03S-1. 171657Z November 2002 TRMM color composite of TC 03S (Boura), 410 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.

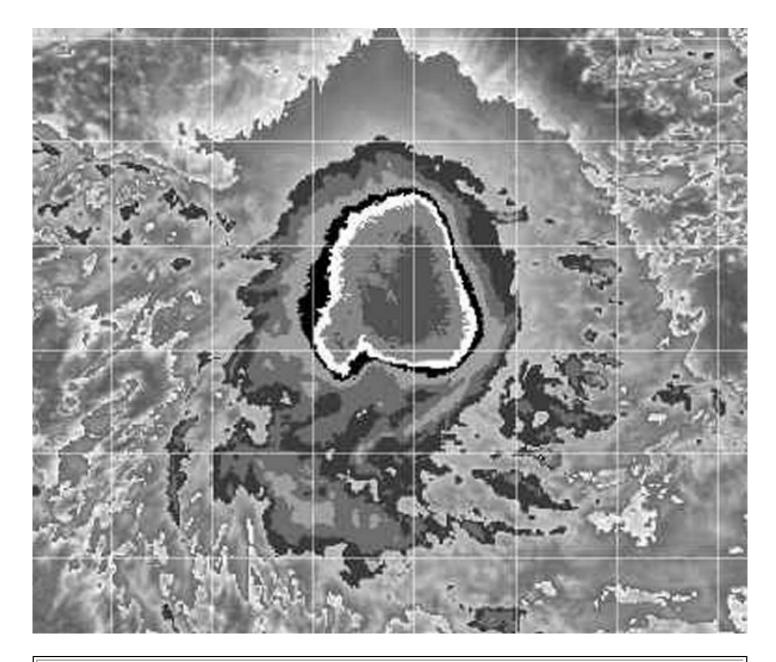
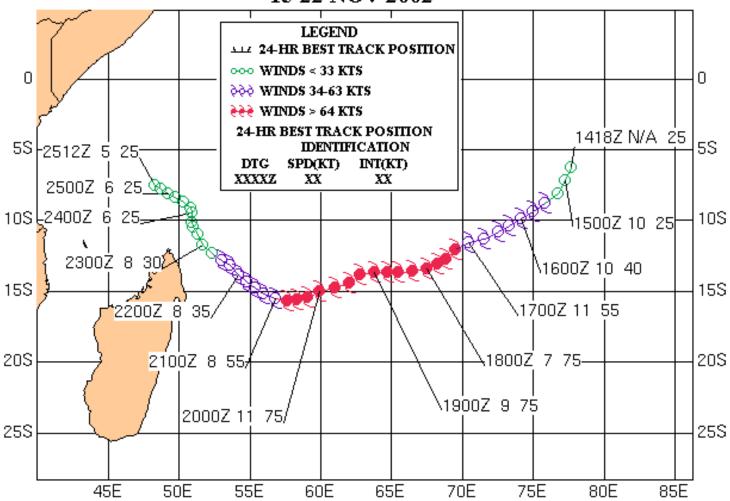
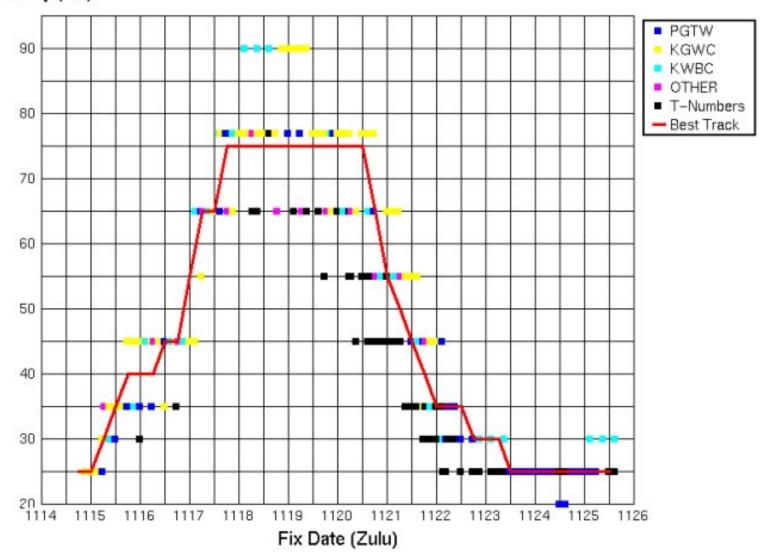


Figure 2-03S-2. 181407Z November 2002 enhanced infrared image of TC 03S (Boura), 555 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.

#### TROPICAL CYCLONE 03S (BOURA) 15-22 NOV 2002



# Time Intensity for 03S



### Tropical Cyclone (TC) 03S (Boura)\*



First Poor: 1800Z 14 Nov 02

First Fair: 2300Z 14 Nov 02

First TCFA: 0830Z 15 Nov 02

First Warning: 1200Z 15 Nov 02

Last Warning: 0000Z 22 Nov 02, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: None

Total Warnings: 22

Remarks:

- (1) Tropical Cyclone (TC) 03S was first noted as a tropical disturbance on 14 November 2002, as it developed in conjunction with an equatorial westerly wind-burst. TC 03S became a significant tropical cyclone approximately 205 nm east-southeast of Diego Garcia. TC 03S tracked southwestward towards Mauritius until 20 November at 18Z under the steering influence of a midlevel subtropical ridge to the southeast. Subsequently, a migatory high moving eastward off of Madagascar caused the cyclone to move northwest until it dissipated under strong vertical wind shear. The remnant low level circulation center to tracked north of Madagascar and dissipated.
- (2) No damage was reported for this system.

#### **Statistics for JTWC on TC03S**

|          | WRN | BEST  | TRACK |      | PO | SIT | ION | ERR | ORS |     |    |     | WIN | ID E | RRC | DRS |     |     |    |     |
|----------|-----|-------|-------|------|----|-----|-----|-----|-----|-----|----|-----|-----|------|-----|-----|-----|-----|----|-----|
| DTG      | NO. | LAT   | LONG  | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 02111418 |     | 6.3S  | 77.7E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111500 |     | 7.2S  | 77.2E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111506 |     | 8.1S  | 76.7E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02111512 | 1   | 8.8S  | 75.8E | 35   | 13 | 17  | 32  | 94  | 141 | 276 |    |     | 0   | 0    | -5  | -10 | -15 | -20 |    |     |
| 02111518 | 2   | 9.4S  | 75.0E | 40   | 11 | 43  | 99  | 169 | 187 | 281 |    |     | 0   | 5    | 5   | -10 | -20 | -15 |    |     |
| 02111600 | 3   | 9.9S  | 74.1E | 40   | 25 | 34  | 88  | 132 | 144 | 231 |    |     | 0   | 0    | -5  | -15 | -25 | -15 |    |     |
| 02111606 | 4   | 10.4S | 73.3E | 40   | 5  | 42  | 77  | 89  | 106 | 151 |    |     | 0   | 0    | -15 | -25 | -20 | -15 |    |     |
| 02111612 | 5   | 10.8S | 72.5E | 45   | 0  | 42  | 51  | 42  | 72  | 153 |    |     | 0   | -5   | -10 | -15 | -10 | -10 |    |     |
| 02111618 | 6   | 11.3S | 71.5E | 45   | 39 | 63  | 59  | 69  | 72  | 152 |    |     | 0   | -15  | -20 | -15 | -10 | -15 |    |     |
| 02111700 | 7   | 11.6S | 70.4E | 55   | 67 | 77  | 64  | 88  | 71  | 159 |    |     | -5  | -10  | -15 | -10 | -10 | -15 |    |     |
| 02111706 | 8   | 12.1S | 69.5E | 65   | 5  | 24  | 26  | 70  | 59  | 112 |    |     | 0   | -5   | 0   | 0   | 0   | 5   |    |     |
| 02111712 | 9   | 12.7S | 68.8E | 65   | 0  | 36  | 23  | 47  | 49  | 116 |    |     | 0   | -5   | 0   | 0   | -5  | -10 |    |     |
| 02111718 | 10  | 13.1S | 68.2E | 75   | 11 | 42  | 59  | 67  | 27  | 103 |    |     | 0   | 5    | 5   | 5   | 0   | 10  |    |     |
| 02111800 | 11  | 13.4S | 67.5E | 75   | 12 | 44  | 54  | 31  | 43  | 117 |    |     | 0   | 5    | 0   | -5  | -5  | 15  |    |     |
| 02111806 | 12  | 13.6S | 66.5E | 75   | 11 | 13  | 18  | 75  | 96  | 97  |    |     | 0   | 0    | 0   | -5  | 5   | 20  |    |     |
| 02111812 | 13  | 13.7S | 65.5E | 75   | 6  | 25  | 37  | 48  | 83  | 65  |    |     | 0   | -5   | -5  | -10 | -10 | 20  |    |     |
| 02111818 | 14  | 13.7S | 64.7E | 75   | 0  | 12  | 64  | 104 | 139 | 164 |    |     | 0   | -5   | -5  | 0   | 0   | 25  |    |     |
| 02111900 | 15  | 13.7S | 63.8E | 75   | 5  | 36  | 68  | 112 | 137 | 147 |    |     | 0   | -5   | -5  | -10 | 10  | 25  |    |     |
| 02111906 | 16  | 13.8S | 62.8E | 75   | 6  | 61  | 92  | 122 | 106 | 101 |    |     | 0   | 0    | 5   | 0   | 20  | 25  |    |     |
| 02111912 | 17  | 14.4S | 62.0E | 75   | 5  | 13  | 42  | 63  | 76  | 88  |    |     | 0   | -5   | -5  | 15  | 20  | 25  |    |     |
| 02112000 | 18  | 15.0S | 59.9E | 75   | 6  | 54  | 76  | 83  | 89  |     |    |     | 0   | -5   | 15  | 25  | 30  |     |    |     |
| 02112012 | 19  | 15.6S | 58.3E | 75   | 23 | 37  | 63  | 78  | 97  |     |    |     | -10 | 5    | 10  | 15  | 10  |     |    |     |
| 02112100 | 20  | 15.5S | 56.8E | 55   | 30 | 78  | 126 | 168 | 216 |     |    |     | 10  | 15   | 20  | 15  | 20  |     |    |     |
| 02112112 | 21  | 14.8S | 55.4E | 45   | 0  | 19  | 51  | 86  | 158 |     |    |     | 0   | 0    | 0   | 0   | 0   |     |    |     |
| 02112200 | 22  | 13.8S | 54.2E | 35   | 18 | 27  |     |     |     |     |    |     | 0   | -5   |     |     |     |     |    |     |
| 02112206 |     | 13.2S | 53.6E | 35   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112212 |     | 12.8S | 53.0E | 35   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112218 |     | 12.3S | 52.3E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112300 |     | 11.7S | 51.7E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112306 |     | 11.0S | 51.3E | 30   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112312 |     | 10.5S | 51.0E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |
| 02112318 |     | 10.1S | 50.9E | 25   |    |     |     |     |     |     |    |     |     |      |     |     |     |     |    |     |

| 02112400 | 9.5S | 50.9E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
|----------|------|---------|----|----|----|----|----|-----|-----|--|----|----|----|----|----|----|--|
| 02112406 | 9.1S | 50.8E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112412 | 8.7S | 50.3E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112418 | 8.4S | 49.7E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112500 | 8.1S | 49.2E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112506 | 7.8S | 48.7E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
| 02112512 | 7.5S | 48.3E   | 25 |    |    |    |    |     |     |  |    |    |    |    |    |    |  |
|          |      | AVERAGE |    | 14 | 38 | 61 | 88 | 103 | 148 |  | 1  | 5  | 7  | 10 | 12 | 17 |  |
|          |      | BIAS    |    |    |    |    |    |     |     |  | 0  | -2 | -1 | -3 | -1 | 3  |  |
|          |      | # CASE  |    | 22 | 22 | 21 | 21 | 21  | 17  |  | 22 | 22 | 21 | 21 | 21 | 17 |  |

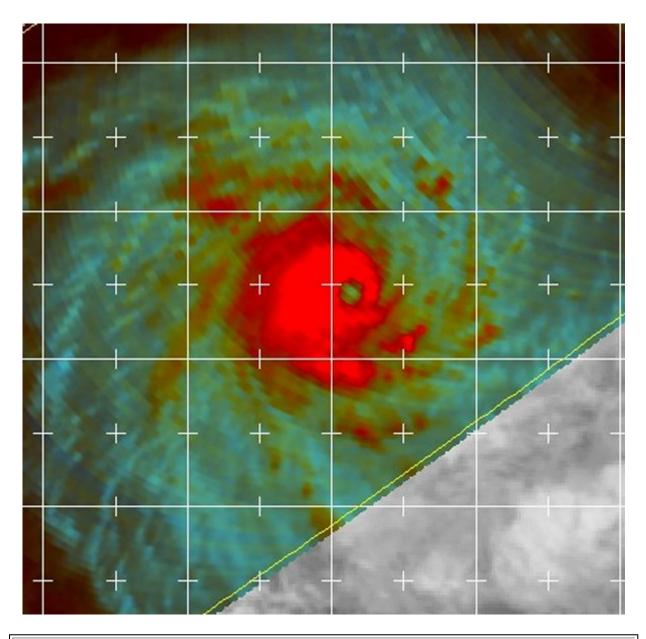


Figure 2-03S-1. 171657Z November 2002 TRMM color composite of TC 03S (Boura), 410 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.

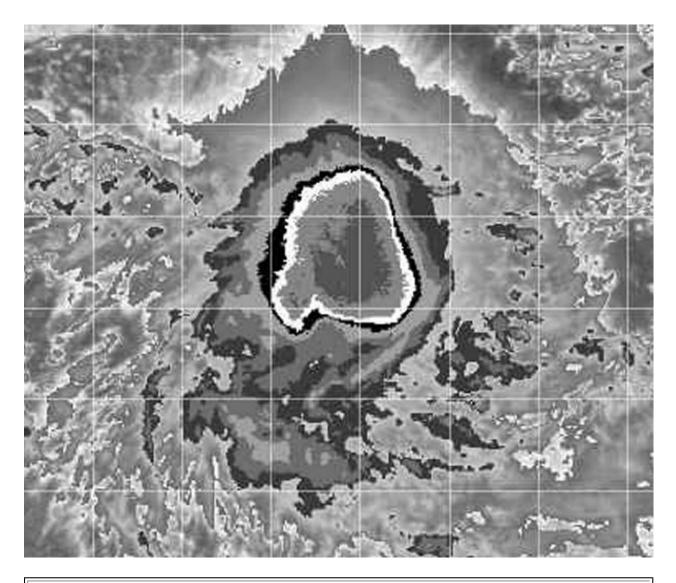
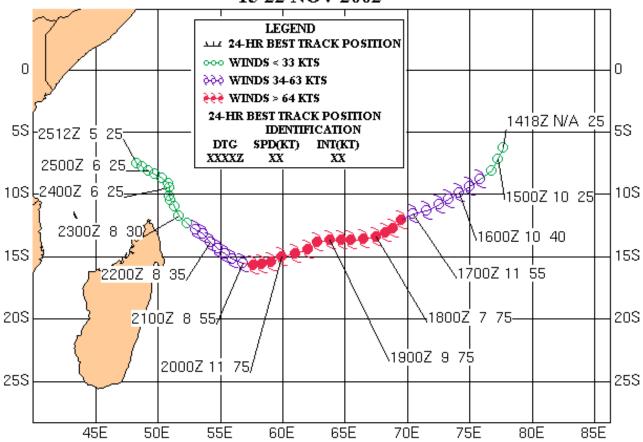
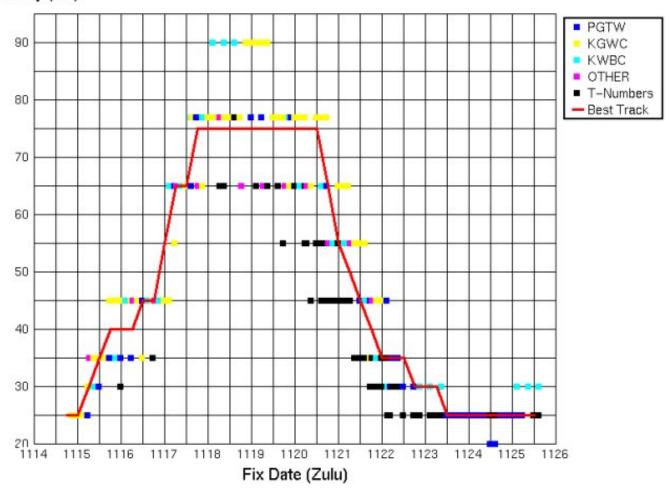


Figure 2-03S-2. 181407Z November 2002 enhanced infrared image of TC 03S (Boura), 555 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.

#### TROPICAL CYCLONE 03S (BOURA) 15-22 NOV 2002



## Time Intensity for 03S



## **Tropical Cyclone (TC) 04P (Yolande)\***



First Poor: 0600Z 30 Nov 02

First Fair: 2300Z 03 Dec 02

First TCFA: 1130Z 04 Dec 02

First Warning: 1800Z 04 Dec 02

Last Warning: 0600Z 05 Dec 02, Extratropical

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 2

Remarks:

(1) The first satellite fix for Tropical Cyclone (TC) 04P occurred on 30 November in a cluster of convective cells embedded within the South Pacific Convergence Zone northeast of Fiji. Only two warnings were issued by JTWC for this system as it quickly transitioned to an extratropical low. TC 04P was a short-lived system whose entire life cycle occurred over open water with no damage or operational impacts reported.

\*Named by WMO designated RSMC

#### Statistics for JTWC on TC04P

|          | WRN | BEST  | TRACK   |      | PO | SIT | ON | ER | ROF | RS |    |     | IIW | ND I | ERF | ROR | S  |    |    |     |
|----------|-----|-------|---------|------|----|-----|----|----|-----|----|----|-----|-----|------|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24 | 36 | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 02120106 |     | 13.2S | 178.3W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120112 |     | 13.5S | 178.0W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120118 |     | 13.8S | 177.6W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120200 |     | 14.1S | 177.2W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120206 |     | 14.7S | 177.2W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120212 |     | 15.1S | 177.3W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120218 |     | 15.3S | 177.5W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120300 |     | 15.5S | 177.6W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120306 |     | 15.6S | 177.8W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120312 |     | 15.7S | 178.1W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120318 |     | 16.0S | 178.1W  | 25   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120400 |     | 16.7S | 178.1W  | 35   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120406 |     | 17.8S | 177.3W  | 30   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120412 |     | 19.1S | 176.3W  | 35   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120418 | 1   | 19.8S | 175.1W  | 35   | 0  | 57  |    |    |     |    |    |     | 5   | 0    |     |     |    |    |    |     |
| 02120506 | 2   | 21.1S | 172.7W  | 35   | 12 |     |    |    |     |    |    |     | 0   |      |     |     |    |    |    |     |
| 02120512 |     | 21.2S | 171.3W  | 30   |    |     |    |    |     |    |    |     |     |      |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 6  | 57  |    |    |     |    |    |     | 3   | 0    |     |     |    |    |    |     |
|          |     |       | BIAS    |      |    |     |    |    |     |    |    |     | 3   | 0    |     |     |    |    |    |     |
|          |     |       | # CASE  |      | 2  | 1   |    |    |     |    |    |     | 2   | 1    |     |     |    |    |    |     |

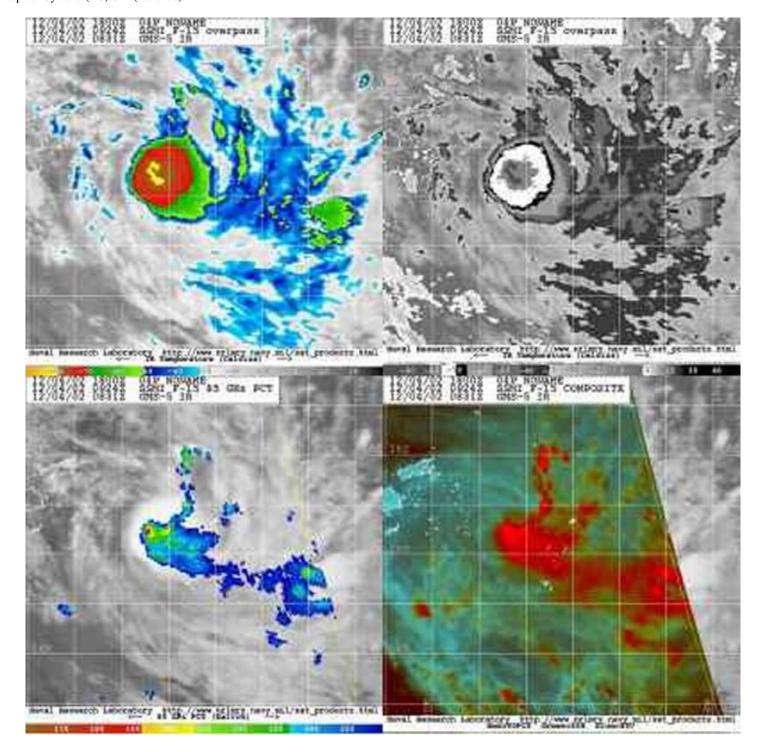
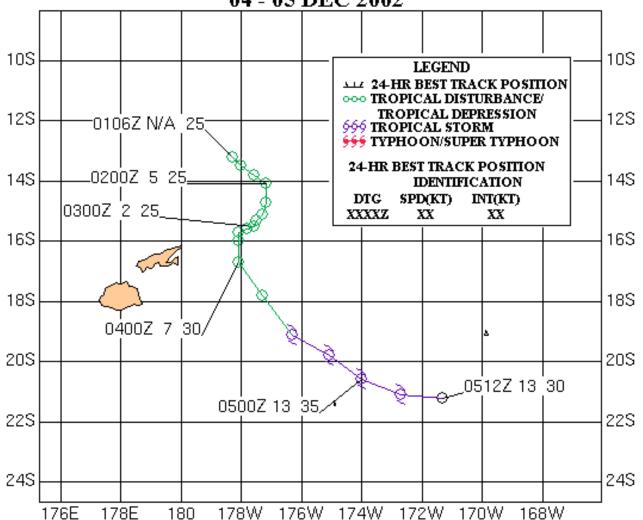
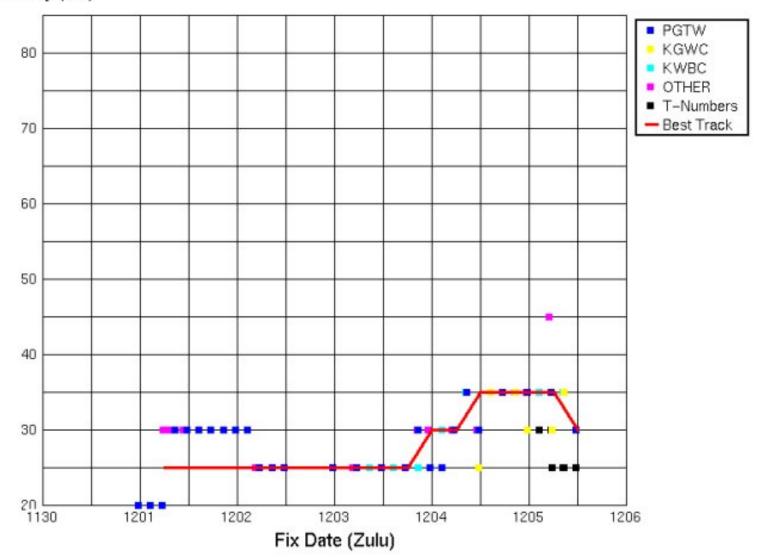


Figure 2-04P-1. 040924Z December 2002 multi-sensor satellite images of TC 04P (Yolande), 385 nm southwest of Pago Pago, with an estimated peak intensity of 40 knots.





# Time Intensity for 04P



## Tropical Cyclone (TC) 04P (Yolande)\*



First Poor: 0600Z 30 Nov 02

First Fair: 2300Z 03 Dec 02

First TCFA: 1130Z 04 Dec 02

First Warning: 1800Z 04 Dec 02

Last Warning: 0600Z 05 Dec 02, Extratropical

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 2

Remarks:

(1) The first satellite fix for Tropical Cyclone (TC) 04P occurred on 30 November in a cluster of convective cells embedded within the South Pacific Convergence Zone northeast of Fiji. Only two warnings were issued by JTWC for this system as it quickly transitioned to an extratropical low. TC 04P was a short-lived system whose entire life cycle occurred over open water with no damage or operational impacts reported.

#### Statistics for JTWC on TC04P

|          | WRN | BEST  | TRACK   |      | РО | SIT | ION | ER | ROF | RS |    |     | 11W | ND I | ERF | ROR | S  |    |    |     |
|----------|-----|-------|---------|------|----|-----|-----|----|-----|----|----|-----|-----|------|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24  | 36 | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 02120106 |     | 13.2S | 178.3W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120112 |     | 13.5S | 178.0W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120118 |     | 13.8S | 177.6W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120200 |     | 14.1S | 177.2W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120206 |     | 14.7S | 177.2W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120212 |     | 15.1S | 177.3W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120218 |     | 15.3S | 177.5W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120300 |     | 15.5S | 177.6W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120306 |     | 15.6S | 177.8W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120312 |     | 15.7S | 178.1W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120318 |     | 16.0S | 178.1W  | 25   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120400 |     | 16.7S | 178.1W  | 35   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120406 |     | 17.8S | 177.3W  | 30   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120412 |     | 19.1S | 176.3W  | 35   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
| 02120418 | 1   | 19.8S | 175.1W  | 35   | 0  | 57  |     |    |     |    |    |     | 5   | 0    |     |     |    |    |    |     |
| 02120506 | 2   | 21.1S | 172.7W  | 35   | 12 |     |     |    |     |    |    |     | 0   |      |     |     |    |    |    |     |
| 02120512 |     | 21.2S | 171.3W  | 30   |    |     |     |    |     |    |    |     |     |      |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 6  | 57  |     |    |     |    |    |     | 3   | 0    |     |     |    |    |    |     |
|          |     |       | BIAS    |      |    |     |     |    |     |    |    |     | 3   | 0    |     |     |    |    |    |     |
|          |     |       | # CASE  |      | 2  | 1   |     |    |     |    |    |     | 2   | 1    |     |     |    |    |    |     |

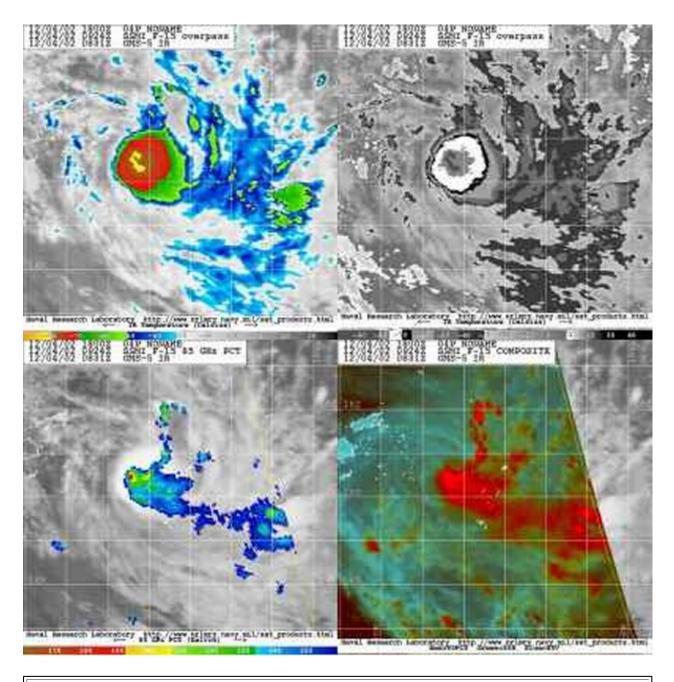
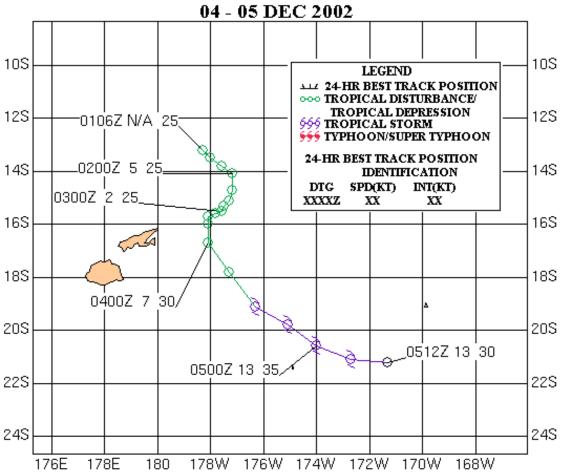
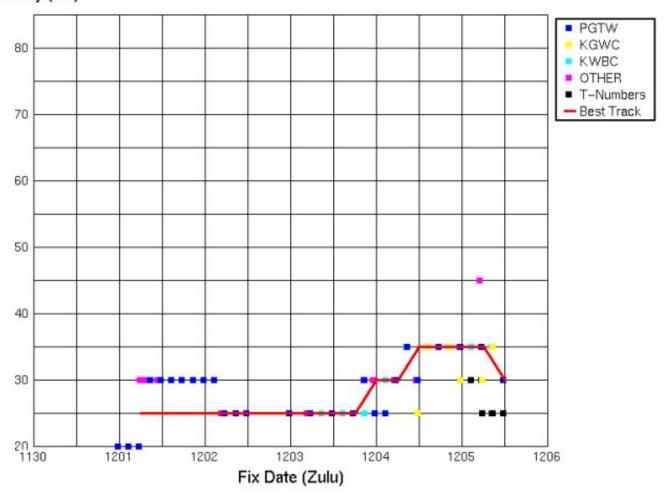


Figure 2-04P-1. 040924Z December 2002 multi-sensor satellite images of TC 04P (Yolande), 385 nm southwest of Pago Pago, with an estimated peak intensity of 40 knots.

## TROPICAL CYCLONE 04P (YOLANDE)



# Time Intensity for 04P



# Tropical Cyclone (TC) 05S (Crystal)\*



First Poor: 0500Z 21 Dec 02

First Fair: 1800Z 22 Dec 02

First TCFA: 0200Z 23 Dec 02

First Warning: 1200Z 23 Dec 02

Last Warning: 0000Z 29 Dec 02, Extratropical

Max Intensity: 90 kts, gusts to 110 kts

Landfall: None

Total Warnings: 12

Remarks:

(1) Tropical Cyclone (TC) 05S was initially described as an area of disturbed weather 145 nm west of Diego Garcia on 21 December, 2002. TC 05S tracked southwestward under the influence of the low to mid-level steering ridge located southeast of the system as it intensified at near a Dvorak T-number per day.

By 0000Z on 25 December, microwave satellite imagery indicated some minor dry air entrainment into the system from the west, with a banding eye feature present. A longwave trough in the midtropospheric westerlies began deepening over the Mozambique Channel, and tracking eastward. This trough began to weaken the steering ridge southeast of TC 05S, creating a more poleward track by 0000Z on 26 December. At 1800Z on 26 December, TC 05S reached a maximum intensity of 90 knots while tracking southward and at 0000Z on 27 December, TC 05S passed 118 nm east of Mauritius. By 0000Z on 28 December, there was no longer an eye feature visible and the cyclone had begun extratropical transition and was finaled 24 hours later as an extratropical system.

(2) Despite having passed within 50 nm of St. Brandon and 118 nm of Mauritius, there were no reports of significant damage caused by this system.

|          |     |       | ;       | Statis | tics | s fo | r J | ΓW | C o | n T | C0: | 5S  |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|--------|------|------|-----|----|-----|-----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |        |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |        | РО   | SIT  | ION | ER | RO  | RS  |     |     | WIN | ID E | RRO | RS  |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind   | 00   | 12   | 24  | 36 | 48  | 72  | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 02122206 |     | 7.9S  | 69.1E   | 25     |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
| 02122212 |     | 8.4S  | 68.9E   | 25     |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
| 02122218 |     | 9.0S  | 68.6E   | 25     |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
| 02122300 |     | 9.6S  | 67.9E   | 25     |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
| 02122306 |     | 10.3S | 67.2E   | 25     |      |      |     |    |     |     |     |     |     |      |     |     |     |    |    |     |
| 02122312 | 1   | 11.0S | 66.5E   | 35     | 5    | 21   | 42  | 42 | 26  |     |     |     | 0   | -5   | -10 | -15 | -10 |    |    |     |
| 02122400 | 2   | 12.3S | 65.0E   | 45     | 11   | 8    | 33  | 50 | 55  |     |     |     | 0   | 0    | 0   | 5   | 20  |    |    |     |
| 02122412 | 3   | 13.5S | 63.4E   | 55     | 11   | 8    | 6   | 32 | 72  |     |     |     | 0   | 0    | 0   | 15  | 15  |    |    |     |
| 02122500 | 4   | 14.5S | 62.2E   | 65     | 17   | 25   | 42  | 60 | 38  |     |     |     | 0   | 0    | 15  | 10  | 5   |    |    |     |
| 02122512 | 5   | 15.6S | 61.2E   | 75     | 6    | 38   | 61  | 77 | 84  |     |     |     | 0   | 15   | 5   | -15 | -20 |    |    |     |
| 02122600 | 6   | 16.9S | 60.2E   | 70     | 12   | 6    | 25  | 43 | 69  |     |     |     | 0   | -10  | -30 | -30 | -25 |    |    |     |
| 02122612 | 7   | 18.4S | 59.7E   | 80     | 8    | 6    | 8   | 20 | 36  |     |     |     | -10 | -25  | -30 | -25 | -20 |    |    |     |
| 02122700 | 8   | 19.9S | 59.5E   | 90     | 5    | 8    | 12  | 42 | 25  |     |     |     | 0   | 0    | 0   | 5   | 30  |    |    |     |
| 02122712 | 9   | 21.5S | 59.9E   | 90     | 8    | 22   | 26  | 43 |     |     |     |     | -10 | -10  | -10 | 15  |     |    |    |     |
| 02122800 | 10  | 23.2S | 60.6E   | 80     | 33   | 80   | 72  |    |     |     |     |     | 0   | 0    | 15  |     |     |    |    |     |
| 02122812 | 11  | 25.0S | 61.1E   | 70     | 8    | 20   |     |    |     |     |     |     | 0   | 20   |     |     |     |    |    |     |
| 02122900 | 12  | 26.6S | 62.9E   | 40     | 20   |      |     |    |     |     |     |     | 0   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |        | 12   | 22   | 33  | 46 | 51  |     |     |     | 2   | 8    | 12  | 15  | 18  |    |    |     |
|          |     |       | BIAS    |        |      |      |     |    |     |     |     |     | -2  | -1   | -5  | -4  | -1  |    |    |     |
|          |     |       | # CASE  |        | 12   | 11   | 10  | 9  | 8   |     |     |     | 12  | 11   | 10  | 9   | 8   |    |    |     |

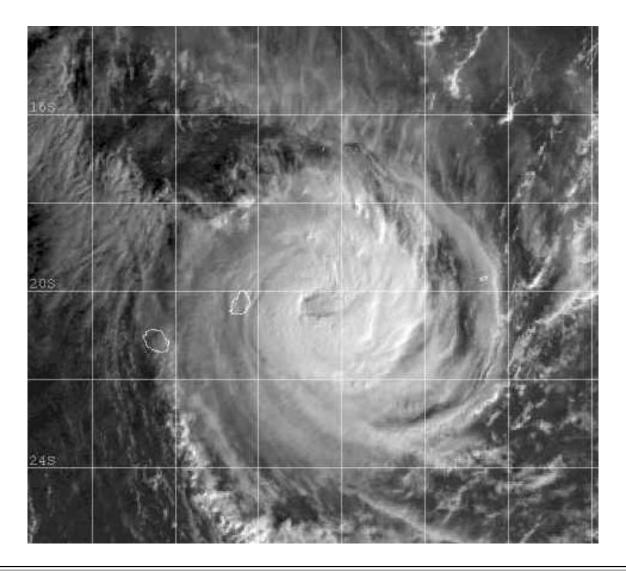


Figure 2-05S-1. 270300Z December 2002 MET-5 visible image of TC 05S (Crystal), 135 nm east of Mauritius island, with an estimated peak intensity of 90 knots.

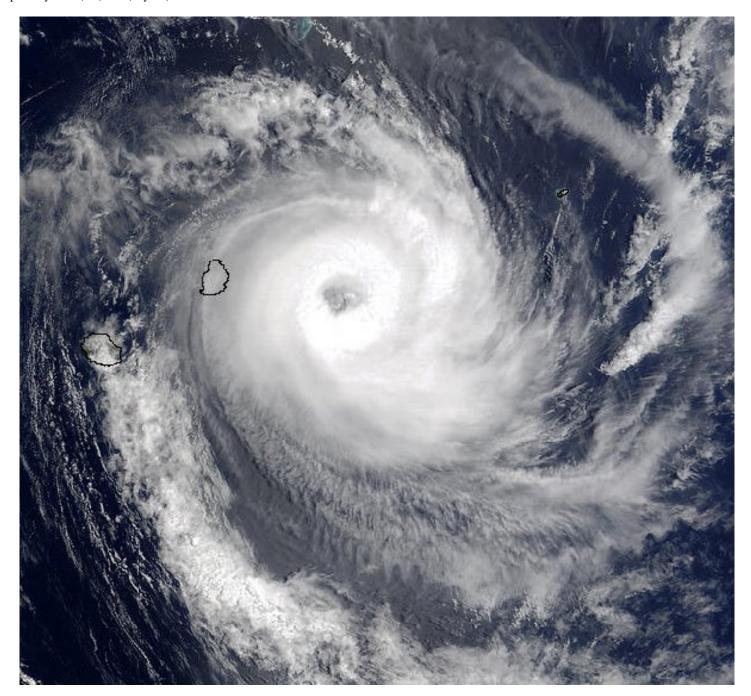
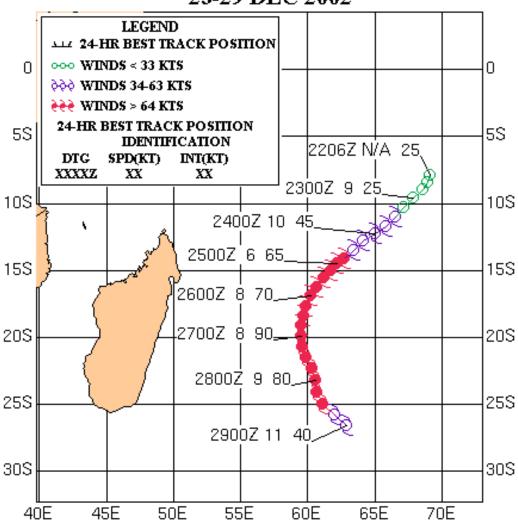
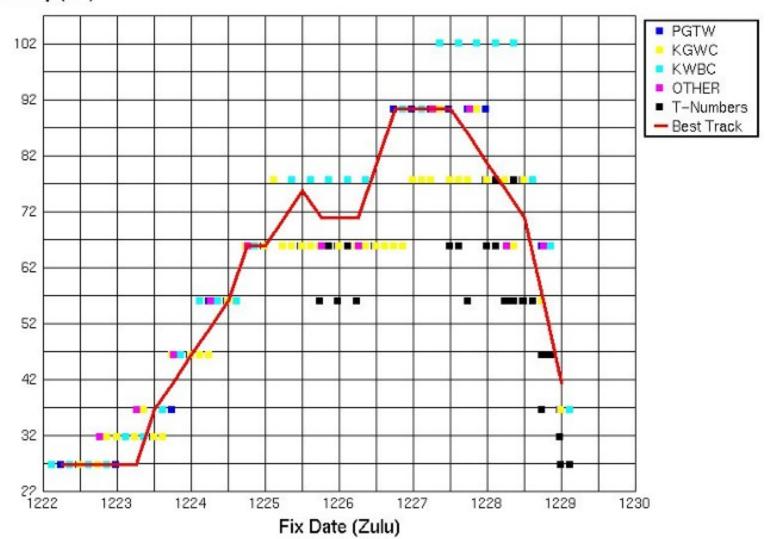


Figure 2-05S-2. 270630Z December 2002 MODIS true-color image of TC 05S (Crystal), located 125nm east-southeast of Mauritius, with an maximum intensity of 90 knots.

### TROPICAL CYCLONE 05S (CRYSTAL) 23-29 DEC 2002



# Time Intensity for 05S



## Tropical Cyclone (TC) 05S (Crystal)\*



First Poor: 0500Z 21 Dec 02

First Fair: 1800Z 22 Dec 02

First TCFA: 0200Z 23 Dec 02

First Warning: 1200Z 23 Dec 02

Last Warning: 0000Z 29 Dec 02, Extratropical

Max Intensity: 90 kts, gusts to 110 kts

Landfall: None

Total Warnings: 12

Remarks:

(1) Tropical Cyclone (TC) 05S was initially described as an area of disturbed weather 145 nm west of Diego Garcia on 21 December, 2002. TC 05S tracked southwestward under the influence of the low to mid-level steering ridge located southeast of the system as it intensified at near a Dvorak T-number per day.

By 0000Z on 25 December, microwave satellite imagery indicated some minor dry air entrainment into the system from the west, with a banding eye feature present. A longwave trough in the midtropospheric westerlies began deepening over the Mozambique Channel, and tracking eastward. This trough began to weaken the steering ridge southeast of TC 05S, creating a more poleward track by 0000Z on 26 December. At 1800Z on 26 December, TC 05S reached a maximum intensity of 90 knots while tracking southward and at 0000Z on 27 December, TC 05S passed 118 nm east of Mauritius. By 0000Z on 28 December, there was no longer an eye feature visible and the cyclone had begun extratropical transition and was finaled 24 hours later as an extratropical system.

(2) Despite having passed within 50 nm of St. Brandon and 118 nm of Mauritius, there were no reports of significant damage caused by this system.

|          |     |       | ;       | Statis | tics | s fo | r J | ΓW | Со | n T | C0: | 5 <b>S</b> |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|--------|------|------|-----|----|----|-----|-----|------------|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |        |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |        | РО   | SIT  | ION | ER | RO | RS  |     |            | WIN | ID E | RRO | RS  |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind   | 00   | 12   | 24  | 36 | 48 | 72  | 96  | 120        | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 02122206 |     | 7.9S  | 69.1E   | 25     |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
| 02122212 |     | 8.4S  | 68.9E   | 25     |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
| 02122218 |     | 9.0S  | 68.6E   | 25     |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
| 02122300 |     | 9.6S  | 67.9E   | 25     |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
| 02122306 |     | 10.3S | 67.2E   | 25     |      |      |     |    |    |     |     |            |     |      |     |     |     |    |    |     |
| 02122312 | 1   | 11.0S | 66.5E   | 35     | 5    | 21   | 42  | 42 | 26 |     |     |            | 0   | -5   | -10 | -15 | -10 |    |    |     |
| 02122400 | 2   | 12.3S | 65.0E   | 45     | 11   | 8    | 33  | 50 | 55 |     |     |            | 0   | 0    | 0   | 5   | 20  |    |    |     |
| 02122412 | 3   | 13.5S | 63.4E   | 55     | 11   | 8    | 6   | 32 | 72 |     |     |            | 0   | 0    | 0   | 15  | 15  |    |    |     |
| 02122500 | 4   | 14.5S | 62.2E   | 65     | 17   | 25   | 42  | 60 | 38 |     |     |            | 0   | 0    | 15  | 10  | 5   |    |    |     |
| 02122512 | 5   | 15.6S | 61.2E   | 75     | 6    | 38   | 61  | 77 | 84 |     |     |            | 0   | 15   | 5   | -15 | -20 |    |    |     |
| 02122600 | 6   | 16.9S | 60.2E   | 70     | 12   | 6    | 25  | 43 | 69 |     |     |            | 0   | -10  | -30 | -30 | -25 |    |    |     |
| 02122612 | 7   | 18.4S | 59.7E   | 80     | 8    | 6    | 8   | 20 | 36 |     |     |            | -10 | -25  | -30 | -25 | -20 |    |    |     |
| 02122700 | 8   | 19.9S | 59.5E   | 90     | 5    | 8    | 12  | 42 | 25 |     |     |            | 0   | 0    | 0   | 5   | 30  |    |    |     |
| 02122712 | 9   | 21.5S | 59.9E   | 90     | 8    | 22   | 26  | 43 |    |     |     |            | -10 | -10  | -10 | 15  |     |    |    |     |
| 02122800 | 10  | 23.2S | 60.6E   | 80     | 33   | 80   | 72  |    |    |     |     |            | 0   | 0    | 15  |     |     |    |    |     |
| 02122812 | 11  | 25.0S | 61.1E   | 70     | 8    | 20   |     |    |    |     |     |            | 0   | 20   |     |     |     |    |    |     |
| 02122900 | 12  | 26.6S | 62.9E   | 40     | 20   |      |     |    |    |     |     |            | 0   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |        | 12   | 22   | 33  | 46 | 51 |     |     |            | 2   | 8    | 12  | 15  | 18  |    |    |     |
|          |     |       | BIAS    |        |      |      |     |    |    |     |     |            | -2  | -1   | -5  | -4  | -1  |    |    |     |
|          |     |       | # CASE  |        | 12   | 11   | 10  | 9  | 8  |     |     |            | 12  | 11   | 10  | 9   | 8   |    |    |     |

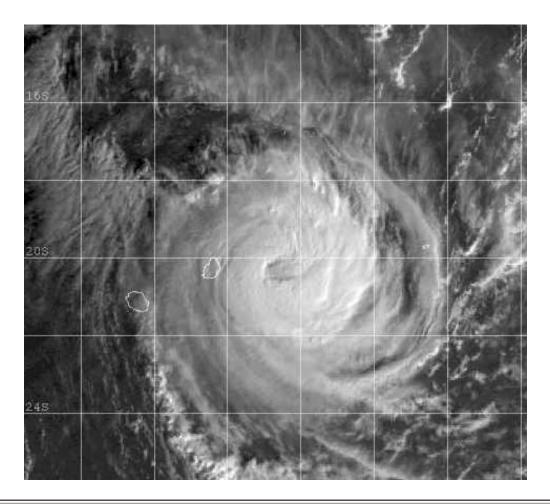


Figure 2-05S-1. 270300Z December 2002 MET-5 visible image of TC 05S (Crystal), 135 nm east of Mauritius island, with an estimated peak intensity of 90 knots.

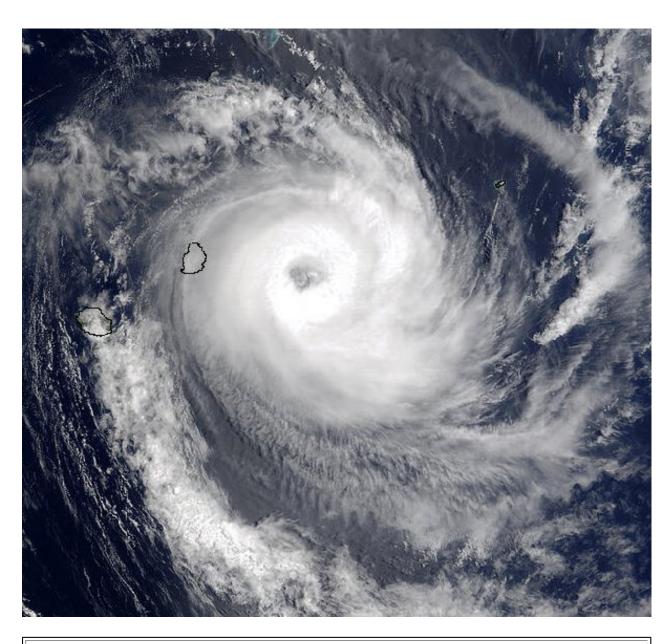
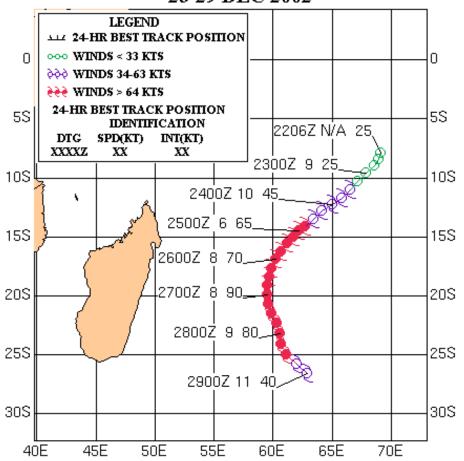
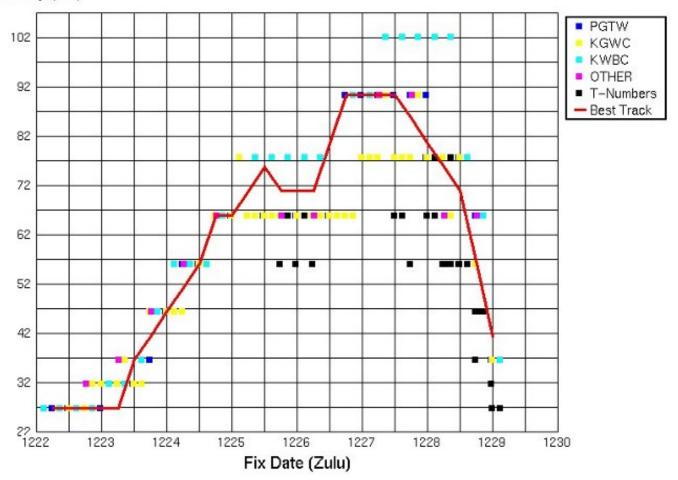


Figure 2-05S-2. 270630Z December 2002 MODIS true-color image of TC 05S (Crystal), located 125nm east-southeast of Mauritius, with an maximum intensity of 90 knots.

#### TROPICAL CYCLONE 05S (CRYSTAL) 23-29 DEC 2002



# Time Intensity for 05S



# Tropical Cyclone (TC) 06P (Zoe)\*



First Poor: 0600Z 24 Dec 02

First Fair: 1930Z 24 Dec 02

First TCFA: 0830Z 25 Dec 02

First Warning: 1200Z 25 Dec 02

Last Warning: 0000Z 01 Jan 03, Extratropical

Max Intensity: 155 kts, gusts to 190 kts

Landfall: None

Total Warnings: 14

Remarks:

(1) Tropical Cyclone (TC) 06P was initially detected and described as a tropical disturbance in the South Pacific Convergence Zone on 24 December, 2002. Rapid development of the tropical disturbance due to an excellent poleward outflow channel caused JTWC to issue the first warning by 1200Z on 25 December.

Metsat data indicated that within 24 hours after the initial warning, the cyclone intensified from 35 knots to 75 knots, a rate of 2 Dvorak T-numbers per day. By 1200Z on 27 December, TC 06P had intensified to 155 knots, a rate of 3 Dvorak T-numbers per day. This rapid development occurred due to consistently decreasing vertical wind shear and excellent outflow in all quadrants, especially in the poleward direction. After reaching peak intensity, TC 06P began to slow in track speed, eventually stalling and maintaining an intensity at or above 100 knots. After 0000Z on 30 December, TC 06P recurved towards the southeast as a mid-level trough influenced a weakness in the ridge and the cyclone began rapid extratropical transition. Extratropical transition occurred south-southwest of the Fiji Islands.

(2) TC 06P is noted for its 155 knot maximum intensity and the damage caused when the TC passed near several small islands in the Temotu Province of the Solomon Islands. Damage done by passage of TC 06P was reported as relatively light on the island of Anuta, with most structures remaining intact. Early reports indicated damage was substantial on the island of Tikopia, though

there was no initial loss of life or serious injuries reported. The islands have a combined population of approximately 3,700 individuals. During the first fly-over by a humanitarian mission after communications were lost with the islands, the devastation to the islands was reported as "total". Much of the vegetation used for food or shelter was denuded. Most major structures were damaged or destroyed. All fresh water sources with the exception of a spring accessible only at low tide were contaminated by salt water according to early reports. Based on the traditional lives of the inhabitants, self-sufficiency was not considered likely for Tikopia for several years.

|          | Statistics for JTWC on TC06P |       |        |      |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
|----------|------------------------------|-------|--------|------|----|-----|-----|-----|------|----|----|-----|----|------|-----|-----|-----|----|----|-----|
|          |                              |       |        |      |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
|          | WRN                          | BEST  | TRACK  |      | PO | SIT | ION | ERF | RORS | 3  |    |     | WI | ND E | RR  | ORS |     |    |    |     |
| DTG      | NO.                          | LAT   | LONG   | wind | 00 | 12  | 24  | 36  | 48   | 72 | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 02122412 |                              | 9.0S  | 178.3W | 15   |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 02122418 |                              | 9.7S  | 179.1W | 25   |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 02122500 |                              | 10.4S | 180.0W | 25   |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 02122506 |                              | 10.8S | 178.9E | 30   |    |     |     |     |      |    |    |     |    |      |     |     |     |    |    |     |
| 02122512 | 1                            | 10.8S | 177.6E | 35   | 13 | 65  | 80  | 81  | 77   |    |    |     | 0  | -10  | -25 | -35 | -90 |    |    |     |
| 02122600 | 2                            | 10.7S | 175.4E | 55   | 11 | 37  | 77  | 85  | 122  |    |    |     | 0  | -10  | -20 | -70 | -65 |    |    |     |
| 02122612 | 3                            | 10.8S | 174.0E | 75   | 17 | 30  | 31  | 46  | 41   |    |    |     | 0  | 0    | -50 | -45 | -30 |    |    |     |
| 02122700 | 4                            | 11.2S | 172.5E | 95   | 8  | 26  | 13  | 24  | 31   |    |    |     | 0  | -45  | -30 | -20 | 0   |    |    |     |
| 02122712 | 5                            | 11.7S | 170.7E | 155  | 5  | 32  | 50  | 80  | 96   |    |    |     | 0  | 10   | 25  | 45  | 55  |    |    |     |
| 02122800 | 6                            | 12.1S | 169.9E | 155  | 8  | 13  | 55  | 75  | 97   |    |    |     | 0  | 10   | 35  | 45  | 40  |    |    |     |
| 02122812 | 7                            | 12.4S | 169.2E | 145  | 6  | 59  | 71  | 77  | 91   |    |    |     | 0  | 20   | 30  | 25  | 40  |    |    |     |
| 02122900 | 8                            | 12.7S | 169.5E | 120  | 0  | 13  | 6   | 23  | 58   |    |    |     | 0  | 10   | 5   | 10  | 20  |    |    |     |
| 02122912 | 9                            | 13.5S | 170.4E | 100  | 8  | 21  | 50  | 56  | 54   |    |    |     | 0  | -5   | 5   | 10  | 0   |    |    |     |
| 02123000 | 10                           | 14.4S | 171.5E | 95   | 8  | 25  | 55  | 41  | 36   |    |    |     | 0  | 5    | 20  | 5   | 0   |    |    |     |
| 02123012 | 11                           | 15.5S | 172.3E | 75   | 57 | 70  | 29  | 41  |      |    |    |     | 0  | 10   | 5   | 0   |     |    |    |     |
| 02123100 | 12                           | 16.8S | 173.4E | 55   | 26 | 79  | 111 |     |      |    |    |     | 0  | -10  | -10 |     |     |    |    |     |
| 02123112 | 13                           | 18.6S | 174.8E | 50   | 38 | 62  |     |     |      |    |    |     | 5  | 5    |     |     |     |    |    |     |

| 03010100 | 14 | 20.7S | 175.2E  | 45 | 34 |    |    |    |    |  | 0  |    |    |    |    |  |  |
|----------|----|-------|---------|----|----|----|----|----|----|--|----|----|----|----|----|--|--|
| 03010106 |    | 21.9S | 175.9E  | 45 |    |    |    |    |    |  |    |    |    |    |    |  |  |
|          |    |       | AVERAGE |    | 18 | 41 | 52 | 57 | 70 |  | 0  | 12 | 22 | 28 | 34 |  |  |
|          |    |       | BIAS    |    |    |    |    |    |    |  | 0  | -1 | -1 | -3 | -3 |  |  |
|          |    |       | # CASE  |    | 14 | 13 | 12 | 11 | 10 |  | 14 | 13 | 12 | 11 | 10 |  |  |

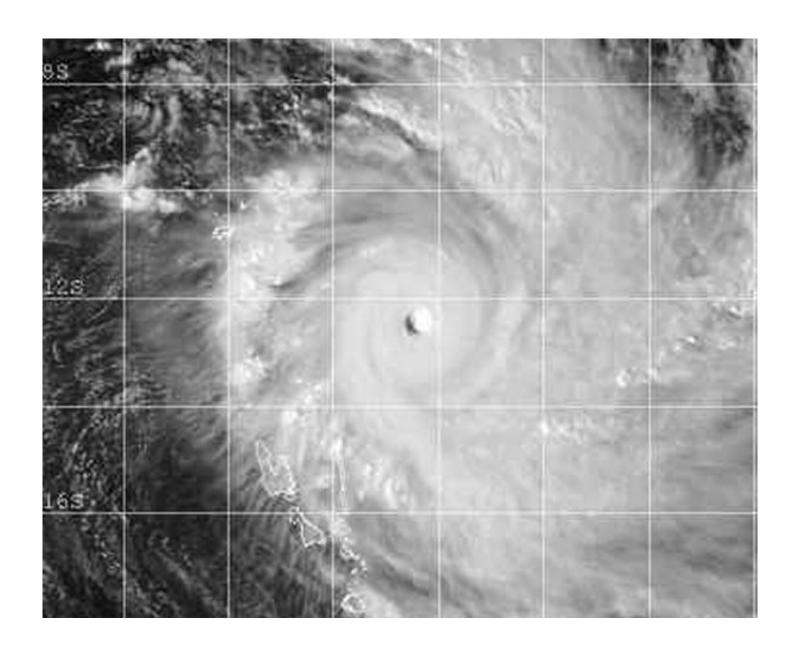


Figure 2-06P-1. 280400Z December 2002 GMS-5 visible imagery of TC 06P (Zoe), 230 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 150 knots.

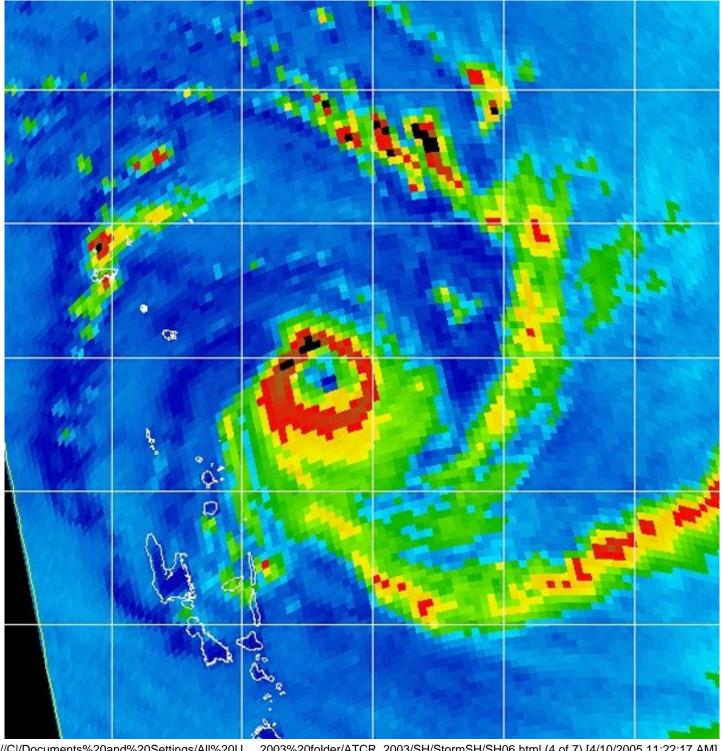


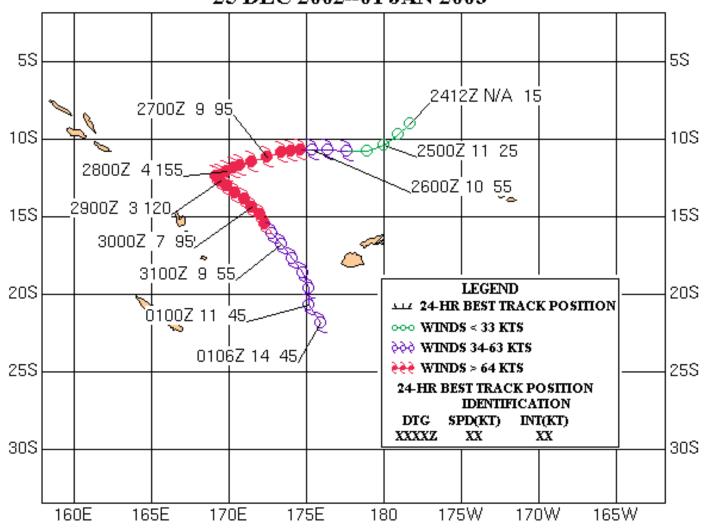


Figure 2-06P-2. 281013Z December 2002 85 GHz SSM/I imagery of TC 06P (Zoe), 210 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 155 knots.

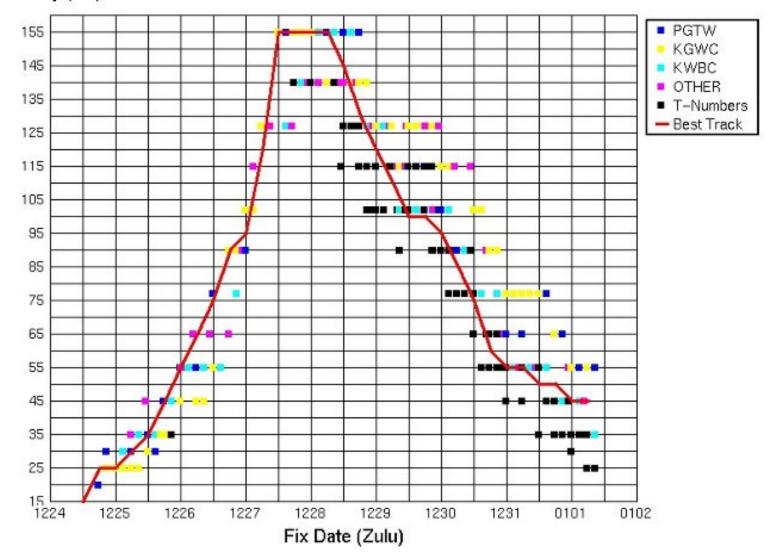


Figure 2-06P-3. 292240Z December 2002 MODIS true-color image of TC 06P (Zoe), located 240nm east-northeast of Port Vila, Vanuatu, with an intensity of 100 knots.

### TROPICAL CYCLONE 06P (ZOE) 25 DEC 2002--01 JAN 2003



# Time Intensity for 06P



### Tropical Cyclone (TC) 06P (Zoe)\*



First Poor : 0600Z 24 Dec 02

First Fair : 1930Z 24 Dec 02

First TCFA: 0830Z 25 Dec 02

First Warning: 1200Z 25 Dec 02

Last Warning: 0000Z 01 Jan 03, Extratropical

Max Intensity: 155 kts, gusts to 190 kts

Landfall: None

Total Warnings: 14

Remarks:

(1) Tropical Cyclone (TC) 06P was initially detected and described as a tropical disturbance in the South Pacific Convergence Zone on 24 December, 2002. Rapid development of the tropical disturbance due to an excellent poleward outflow channel caused JTWC to issue the first warning by 1200Z on 25 December.

Metsat data indicated that within 24 hours after the initial warning, the cyclone intensified from 35 knots to 75 knots, a rate of 2 Dvorak T-numbers per day. By 1200Z on 27 December, TC 06P had intensified to 155 knots, a rate of 3 Dvorak T-numbers per day. This rapid development occurred due to consistently decreasing vertical wind shear and excellent outflow in all quadrants, especially in the poleward direction. After reaching peak intensity, TC 06P began to slow in track speed, eventually stalling and maintaining an intensity at or above 100 knots. After 0000Z on 30 December, TC 06P recurved towards the southeast as a mid-level trough influenced a weakness in the ridge and the cyclone began rapid extratropical transition. Extratropical transition occurred south-southwest of the Fiji Islands.

(2) TC 06P is noted for its 155 knot maximum intensity and the damage caused when the TC passed near several small islands in the Temotu Province of the Solomon Islands. Damage done by passage of TC 06P was reported as relatively light on the island of Anuta, with most structures remaining intact. Early reports indicated damage was substantial on the island of Tikopia, though there was no initial loss of life or serious injuries reported. The islands have a combined population of approximately 3,700 individuals. During the first fly-over by a humanitarian mission after communications were lost with the islands, the devastation to the islands was reported as "total". Much of the vegetation used for food or shelter was denuded. Most major structures were damaged or destroyed. All fresh water sources with the exception of a spring accessible only at low tide were contaminated by salt water according to early reports. Based on the traditional lives

of the inhabitants, self-sufficiency was not considered likely for Tikopia for several years.

|          |     |       |         | Stati | stic | s fo | or Jī | ΓW  | C on | тс       | 061 | )   |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|------|-------|-----|------|----------|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PC   | SIT  | ION   | ERF | RORS | <u> </u> |     |     | WII | ND E | RR  | ORS |     |    | ,  |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12   | 24    | 36  | 48   | 72       | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 02122412 |     | 9.0S  | 178.3W  | 15    |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
| 02122418 |     | 9.7S  | 179.1W  | 25    |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
| 02122500 |     | 10.4S | 180.0W  | 25    |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
| 02122506 |     | 10.8S | 178.9E  | 30    |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
| 02122512 | 1   | 10.8S | 177.6E  | 35    | 13   | 65   | 80    | 81  | 77   |          |     |     | 0   | -10  | -25 | -35 | -90 |    |    |     |
| 02122600 | 2   | 10.7S | 175.4E  | 55    | 11   | 37   | 77    | 85  | 122  |          |     |     | 0   | -10  | -20 | -70 | -65 |    |    |     |
| 02122612 | 3   | 10.8S | 174.0E  | 75    | 17   | 30   | 31    | 46  | 41   |          |     |     | 0   | 0    | -50 | -45 | -30 |    |    |     |
| 02122700 | 4   | 11.2S | 172.5E  | 95    | 8    | 26   | 13    | 24  | 31   |          |     |     | 0   | -45  | -30 | -20 | 0   |    |    |     |
| 02122712 | 5   | 11.7S | 170.7E  | 155   | 5    | 32   | 50    | 80  | 96   |          |     |     | 0   | 10   | 25  | 45  | 55  |    |    |     |
| 02122800 | 6   | 12.1S | 169.9E  | 155   | 8    | 13   | 55    | 75  | 97   |          |     |     | 0   | 10   | 35  | 45  | 40  |    |    |     |
| 02122812 | 7   | 12.4S | 169.2E  | 145   | 6    | 59   | 71    | 77  | 91   |          |     |     | 0   | 20   | 30  | 25  | 40  |    |    |     |
| 02122900 | 8   | 12.7S | 169.5E  | 120   | 0    | 13   | 6     | 23  | 58   |          |     |     | 0   | 10   | 5   | 10  | 20  |    |    |     |
| 02122912 | 9   | 13.5S | 170.4E  | 100   | 8    | 21   | 50    | 56  | 54   |          |     |     | 0   | -5   | 5   | 10  | 0   |    |    |     |
| 02123000 | 10  | 14.4S | 171.5E  | 95    | 8    | 25   | 55    | 41  | 36   |          |     |     | 0   | 5    | 20  | 5   | 0   |    |    |     |
| 02123012 | 11  | 15.5S | 172.3E  | 75    | 57   | 70   | 29    | 41  |      |          |     |     | 0   | 10   | 5   | 0   |     |    |    |     |
| 02123100 | 12  | 16.8S | 173.4E  | 55    | 26   | 79   | 111   |     |      |          |     |     | 0   | -10  | -10 |     |     |    |    |     |
| 02123112 | 13  | 18.6S | 174.8E  | 50    | 38   | 62   |       |     |      |          |     |     | 5   | 5    |     |     |     |    |    |     |
| 03010100 | 14  | 20.7S | 175.2E  | 45    | 34   |      |       |     |      |          |     |     | 0   |      |     |     |     |    |    |     |
| 03010106 |     | 21.9S | 175.9E  | 45    |      |      |       |     |      |          |     |     |     |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 18   | 41   | 52    | 57  | 70   |          |     |     | 0   | 12   | 22  | 28  | 34  |    |    |     |
|          |     |       | BIAS    |       |      |      |       |     |      |          |     |     | 0   | -1   | -1  | -3  | -3  |    |    |     |
|          |     |       | # CASE  |       | 14   | 13   | 12    | 11  | 10   |          |     |     | 14  | 13   | 12  | 11  | 10  |    |    |     |

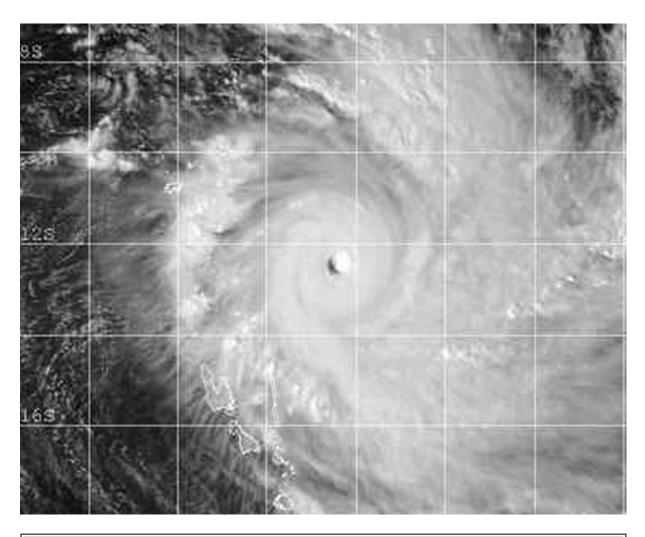


Figure 2-06P-1. 280400Z December 2002 GMS-5 visible imagery of TC 06P (Zoe), 230 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 150 knots.

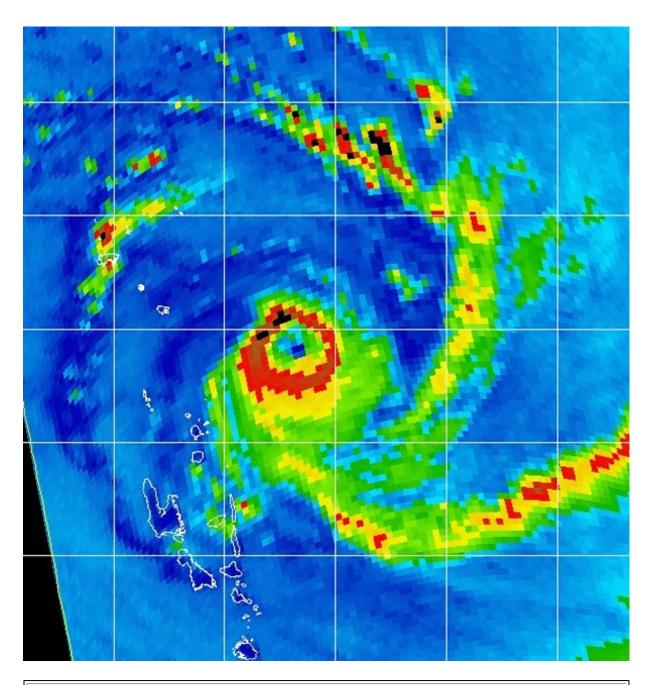
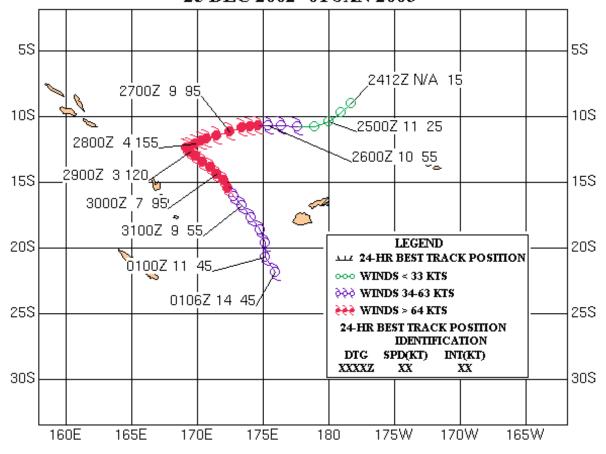


Figure 2-06P-2. 281013Z December 2002 85 GHz SSM/I imagery of TC 06P (Zoe), 210 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 155 knots.

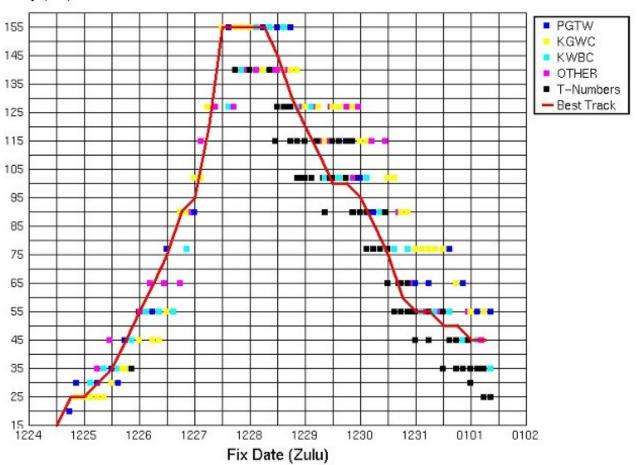


Figure 2-06P-3. 292240Z December 2002 MODIS true-color image of TC 06P (Zoe), located 240nm east-northeast of Port Vila, Vanuatu, with an intensity of 100 knots.

#### TROPICAL CYCLONE 06P (ZOE) 25 DEC 2002--01 JAN 2003



# Time Intensity for 06P



# **Tropical Cyclone (TC) 07S**



First Poor: 1530Z 25 Dec 02

First Fair: N/A

First TCFA: 1800Z 25 Dec 02

First Warning: 1800Z 26 Dec 02

Last Warning: 1800Z 28 Dec 02, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: None

Total Warnings: 5

Remarks:

- (1) Tropical Cyclone (TC) 07S was first noted as a tropical disturbance west of Sumatra on 25 December 2002. The first warning was issued with an intensity of 30 knots on 26 December. TC 07S initially tracked poleward toward the Cocos Islands, then turned eastward after 27 December under the influence of a near equatorial ridge located north of the cyclone. The cyclone was tracked as a 30 knot cyclone for more than 8 days before dissipating.
- (2) No damage or casualties were reported for this tropical cyclone.

#### **Statistics for JTWC on TC07S**

| DTG N<br>02122500 | <b>10</b> . |       |       |      | POSITION ERRORS |    |     |     |     |    |    |     |    |    | <b>⊢</b> 1 / 1 ′ | ROR | .0 |    |    |     |
|-------------------|-------------|-------|-------|------|-----------------|----|-----|-----|-----|----|----|-----|----|----|------------------|-----|----|----|----|-----|
| 02122500          | <b>1</b> O. | LAT   | LONG  | wind | 00              | 12 | 24  | 36  | 48  | 72 | 96 | 120 | 00 | 12 | 24               | 36  | 48 | 72 | 96 | 120 |
|                   |             | 2.8S  | 88.5E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122506          |             | 3.7S  | 87.9E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122512          |             | 4.7S  | 87.4E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122518          |             | 5.7S  | 87.7E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122600          |             | 6.6S  | 88.0E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122606          |             | 7.4S  | 88.4E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122612          |             | 8.1S  | 88.8E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122618 1        | I           | 8.7S  | 89.1E | 30   | 11              | 34 | 94  | 197 | 297 |    |    |     | 0  | 5  | 10               | 15  | 15 |    |    |     |
| 02122706 2        | 2           | 9.2S  | 89.8E | 30   | 16              | 96 | 215 | 309 | 374 |    |    |     | 0  | 0  | 5                | 5   | 15 |    |    |     |
| 02122718 3        | 3           | 9.2S  | 91.0E | 30   | 13              | 78 | 112 | 150 | 166 |    |    |     | 0  | 5  | 5                | 10  | 10 |    |    |     |
| 02122806 4        | 1           | 9.3S  | 92.7E | 30   | 24              | 13 | 54  | 95  |     |    |    |     | 0  | 0  | 5                | 5   |    |    |    |     |
| 02122818 5        | 5           | 9.8S  | 93.7E | 30   | 18              | 59 |     |     |     |    |    |     | 0  | 5  |                  |     |    |    |    |     |
| 02122900          |             | 9.98  | 94.0E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122906          |             | 9.8S  | 94.2E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122912          |             | 9.5S  | 94.1E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02122918          |             | 9.6S  | 93.8E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123000          |             | 9.8S  | 93.2E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123006          |             | 9.9S  | 92.8E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123012          |             | 10.0S | 92.4E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123018          |             | 10.0S | 92.0E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123100          |             | 9.98  | 91.7E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123106          |             | 9.8S  | 91.5E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123112          |             | 9.98  | 91.3E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 02123118          |             | 10.0S | 91.2E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010100          |             | 10.0S | 91.5E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010106          |             | 9.8S  | 91.4E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010112          |             | 9.8S  | 91.2E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010118          |             | 9.9S  | 91.1E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010200          |             | 9.98  | 91.4E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010206          |             | 9.7S  | 91.2E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010212          |             | 9.7S  | 91.0E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010218          |             | 9.7S  | 90.8E | 25   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010300          |             | 9.8S  | 90.6E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |
| 03010306          |             | 10.1S | 90.7E | 20   |                 |    |     |     |     |    |    |     |    |    |                  |     |    |    |    |     |

| AVERAGE | 17 | 56 | 119 | 188 | 279 |  | 0 | 3 | 6 | 9 | 13 |  |  |
|---------|----|----|-----|-----|-----|--|---|---|---|---|----|--|--|
| BIAS    |    |    |     |     |     |  | 0 | 3 | 6 | 9 | 13 |  |  |
| # CASE  | 5  | 5  | 4   | 4   | 3   |  | 5 | 5 | 4 | 4 | 3  |  |  |

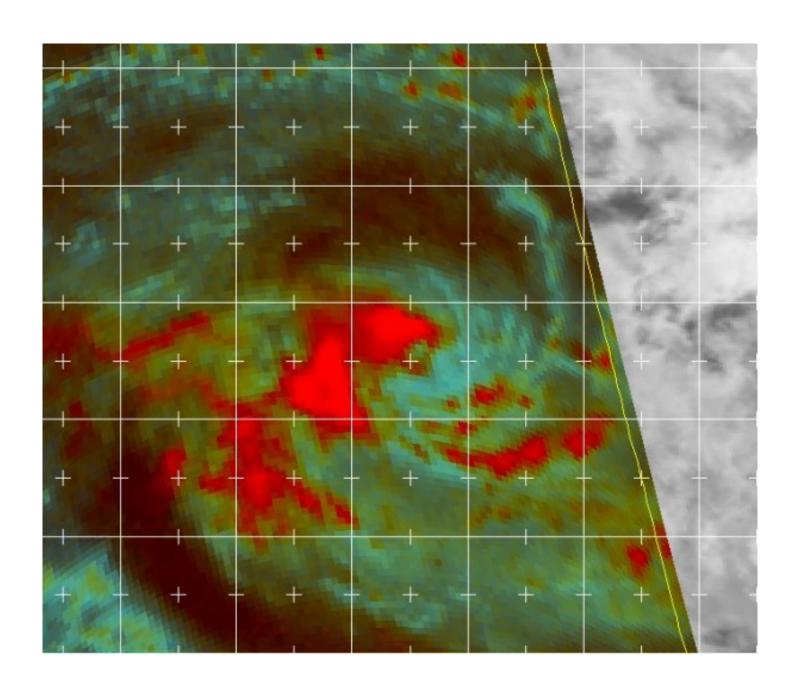
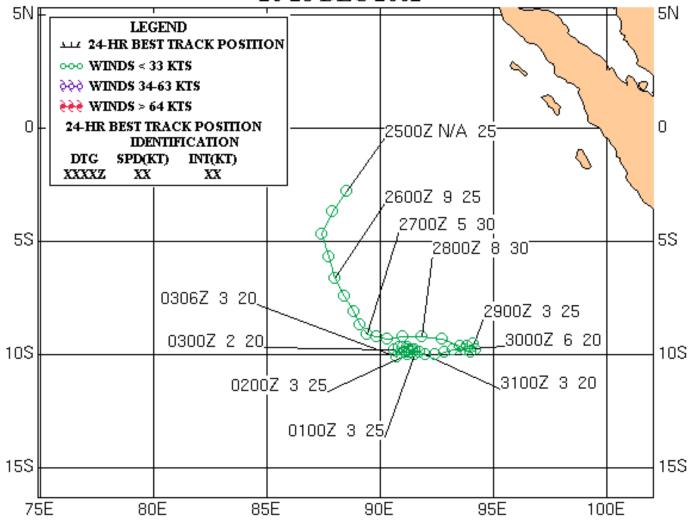
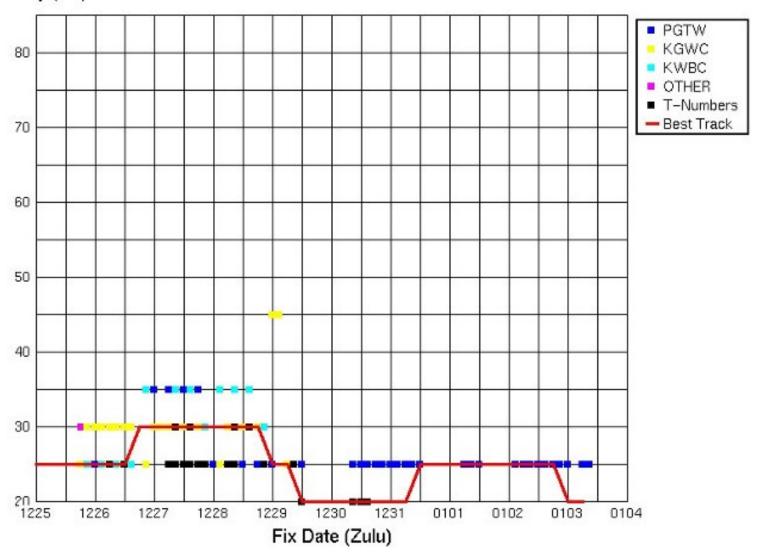


Figure 2-07S-1. 261550Z December 2002 color composite SSM/I image of TC 07S (No Name), 550 nm west-northwest of Cocos island. The system had an partially exposed low level circulation center with an estimated intensity of 25 knots.

#### TROPICAL CYCLONE 07S 26-28 DEC 2002



# Time Intensity for 07S



### **Tropical Cyclone (TC) 07S**



First Poor: 1530Z 25 Dec 02

First Fair: N/A

First TCFA: 1800Z 25 Dec 02

First Warning: 1800Z 26 Dec 02

Last Warning: 1800Z 28 Dec 02, Dissipated

Max Intensity: 30 kts, gusts to 40 kts

Landfall: None

Total Warnings: 5

Remarks:

(1) Tropical Cyclone (TC) 07S was first noted as a tropical disturbance west of Sumatra on 25 December 2002. The first warning was issued with an intensity of 30 knots on 26 December. TC 07S initially tracked poleward toward the Cocos Islands, then turned eastward after 27 December under the influence of a near equatorial ridge located north of the cyclone. The cyclone was tracked as a 30 knot cyclone for more than 8 days before dissipating.

(2) No damage or casualties were reported for this tropical cyclone.

#### Statistics for JTWC on TC07S WRN BEST TRACK **POSITION ERRORS** WIND ERRORS DTG NO. wind 00 12 24 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 LAT LONG 36 48 2.8S 25 02122500 88.5E 02122506 3.7S 87.9E 25 87.4E 02122512 4.7S 25 87.7E 02122518 5.7S 25 02122600 6.6S 88.0E 25 02122606 7.4S 88.4E 25 02122612 8.1S 88.8E 25 11 34 94 02122618 8.7S 89.1E 30 197 297 0 |5 10 | 15 | 15 02122706 9.2S 89.8E 30 16 96 215 309 374 0 0 15 02122718 9.2S 91.0E 30 13 | 78 | 112 | 150 | 166 0 5 5 10 10 02122806 4 9.3S 92.7E 30 24 | 13 | 54 95 0 0 5 5 02122818 | 5 9.8S 93.7E 30 18 59 5 0 02122900 9.98 94.0E 25 94.2E 02122906 9.88 25 02122912 9.5S 94.1E 20 02122918 9.6S 93.8E 20 02123000 9.8S 93.2E 20 02123006 9.98 92.8E 20 10.0S 92.4E 02123012 20 02123018 20 10.0S | 92.0E 02123100 9.98 91.7E 20 02123106 9.8S 91.5E 20 02123112 9.98 91.3E 25 02123118 10.0S 91.2E 25 03010100 10.0S 91.5E 25 03010106 9.88 91.4E 25 03010112 91.2E 25 9.8S 25 03010118 9.98 91.1E 03010200 9.98 91.4E 25 9.7S 91.2E 25 03010206 03010212 9.7S 91.0E 25 03010218 9.7S 90.8E 25 03010300 9.8S 90.6E 20 03010306 10.1S 90.7E 20 **AVERAGE** 17 | 56 | 119 | 188 | 279 0 3 6 9 13 **BIAS** 0 3 6 9 13 # CASE 5 5 4 4 3 5 5 4 4 3

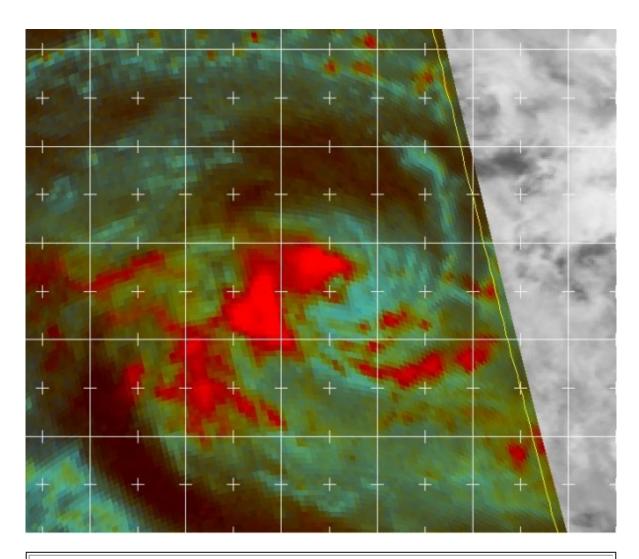
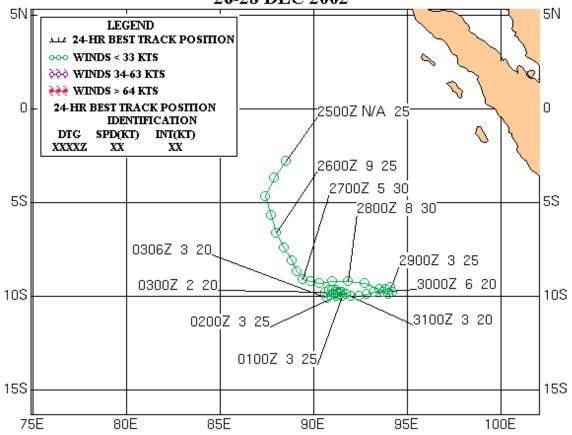
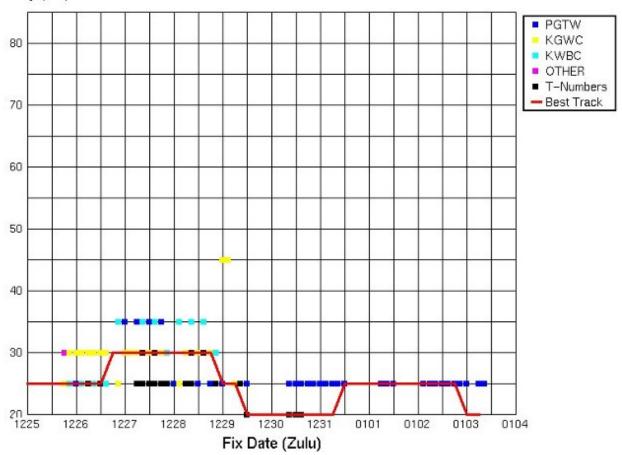


Figure 2-07S-1. 261550Z December 2002 color composite SSM/I image of TC 07S (No Name), 550 nm west-northwest of Cocos island. The system had an partially exposed low level circulation center with an estimated intensity of 25 knots.

#### TROPICAL CYCLONE 07S 26-28 DEC 2002



# Time Intensity for 07S



# Tropical Cyclone (TC) 08S (Delfina)\*



First Poor: 1100Z 30 Dec 02

First Fair: 1200Z 30 Dec 02

First TCFA: N/A

First Warning: 1800Z 30 Dec 02

Last Warning: 0600Z 01 Jan 03, Dissipated

Max Intensity: 55 kts, gusts to 70 kts

Landfall: Near Angoche, Mozambique on 31 December, 2002

Total Warnings: 4

Remarks:

- (1) Tropical Cyclone (TC) 08S developed quickly in the Mozambique Channel and attained a maximum intensity of 55 knots just prior to making landfall in Mozambique. After landfall, the cyclone rapidly weakened. Over land, TC 08S continued to move westward and entered Malawi, entraining hot, desert air and continuing to interact with land. With the low level circulation center still identifiable, TC 08S then looped, headed southeast and re-entered the Mozambique Channel. After re-entering the Mozambique Channel, the cyclone tracked south for 72 hours before dissipating.
- (2) Press reports indicated that TC 08S brought heavy rains and winds to Mozambique, causing a reported 58 fatalities. Reports further indicated that the cyclone left approximately 300,000 persons homeless, damaged crops, and causing infrastructure damage costing \$3.5 million.

|          |     |        | S     | tatist | ics | for | JT' | WC | on  | TC | :08 | S   |     |      |     |     |    |    |    |     |
|----------|-----|--------|-------|--------|-----|-----|-----|----|-----|----|-----|-----|-----|------|-----|-----|----|----|----|-----|
|          |     |        |       |        |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
|          | WRN | BEST 1 | RACK  |        | PO  | SIT | ION | ER | ROI | RS |     |     | WII | ND E | RRC | ORS |    |    |    |     |
| DTG      | NO. | LAT    | LONG  | wind   | 00  | 12  | 24  | 36 | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 02123012 |     | 16.4S  | 43.1E | 30     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 02123018 | 1   | 16.4S  | 42.4E | 35     | 8   | 56  | 83  | 86 |     |    |     |     | 0   | 10   | 0   | -25 |    |    |    |     |
| 02123106 | 2   | 16.1S  | 41.6E | 35     | 18  | 12  | 17  | 63 |     |    |     |     | 0   | -10  | -15 | -5  |    |    |    |     |
| 02123118 | 3   | 16.0S  | 40.4E | 55     | 6   | 13  | 12  |    |     |    |     |     | 0   | -5   | 0   |     |    |    |    |     |
| 03010106 | 4   | 15.8S  | 39.2E | 45     | 5   | 40  |     |    |     |    |     |     | 0   | 10   |     |     |    |    |    |     |
| 03010112 |     | 15.7S  | 38.5E | 30     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010118 |     | 15.6S  | 37.6E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010200 |     | 15.5S  | 36.7E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010206 |     | 15.4S  | 35.7E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010212 |     | 15.3S  | 35.2E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010218 |     | 15.1S  | 35.6E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010300 |     | 15.1S  | 35.7E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010306 |     | 15.1S  | 35.9E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010312 |     | 15.1S  | 36.1E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010318 |     | 15.0S  | 36.3E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010400 |     | 14.9S  | 36.7E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010406 |     | 14.9S  | 37.1E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010412 |     | 14.8S  | 37.5E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010418 |     | 14.8S  | 37.9E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010500 |     | 14.7S  | 38.3E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010506 |     | 14.8S  | 38.8E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010512 |     | 15.1S  | 39.2E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010518 |     | 15.4S  | 39.6E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010600 |     | 15.9S  | 39.9E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010606 |     | 16.5S  | 39.4E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010612 |     | 17.1S  | 38.7E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010618 |     | 17.7S  | 38.2E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010700 |     | 18.4S  | 37.5E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010706 |     | 19.4S  | 37.4E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |
| 03010712 |     | 20.4S  | 37.6E | 25     |     |     |     |    |     |    |     |     |     |      |     |     |    |    |    |     |

|          | , |       | ,       |    |    | ,  |    |    | <br> |  | , |   | ,  | ,   |  |  |
|----------|---|-------|---------|----|----|----|----|----|------|--|---|---|----|-----|--|--|
| 03010718 |   | 21.4S | 37.9E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010800 |   | 22.1S | 38.3E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010806 |   | 22.9S | 38.5E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010812 |   | 23.7S | 38.4E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010818 |   | 24.5S | 38.4E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010900 |   | 25.5S | 38.5E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010906 |   | 26.5S | 38.6E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
| 03010912 |   | 27.5S | 39.6E   | 25 |    |    |    |    |      |  |   |   |    |     |  |  |
|          |   |       | AVERAGE |    | 10 | 30 | 37 | 74 |      |  | 0 | 9 | 5  | 15  |  |  |
|          |   |       | BIAS    |    |    |    |    |    |      |  | 0 | 1 | -5 | -15 |  |  |
|          |   |       | # CASES |    | 4  | 4  | 3  | 2  |      |  | 4 | 4 | 3  | 2   |  |  |

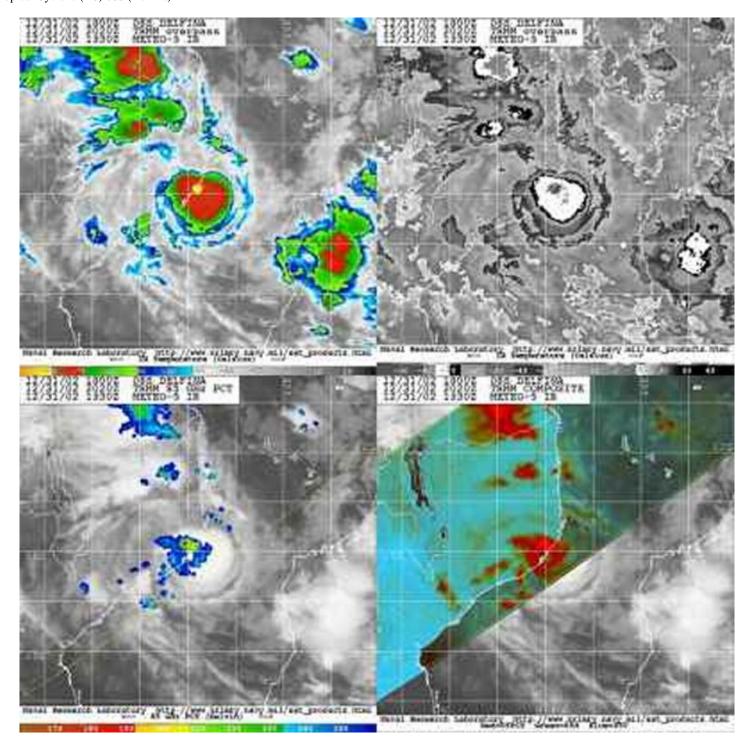


Figure 2-08S-1. 312020Z December 2002 multi-sensor satellite images of TC 08S (Delfina), located in the Mozambique channel, with an estimated intensity of 55 knots.

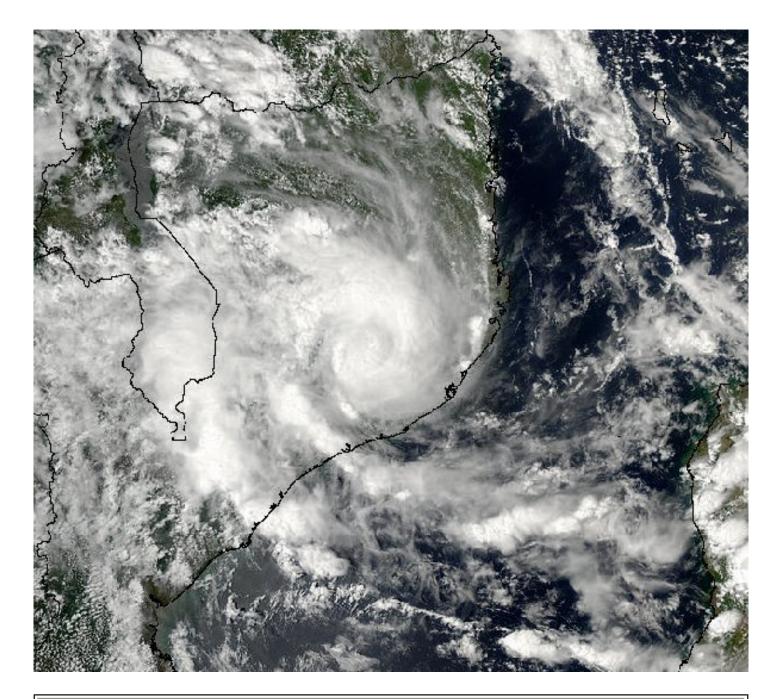
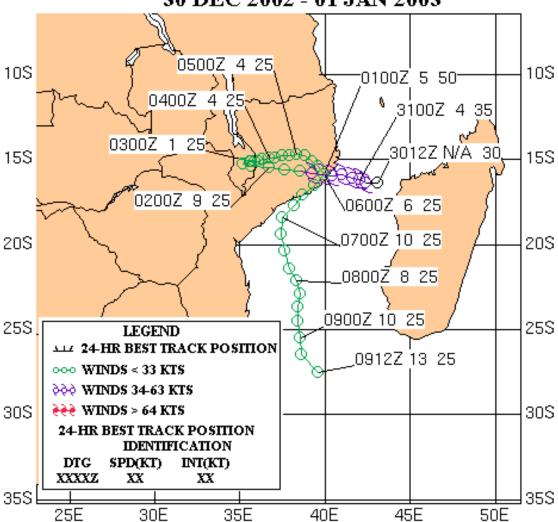
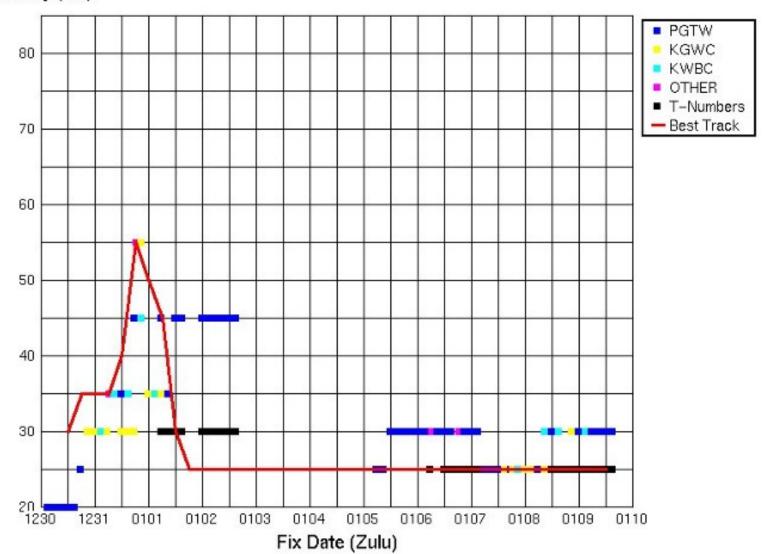


Figure 2-08S-2. 011105Z January 2003 MODIS true-color image of TC 08S (Delfina), located over Mozambique, with an intensity of 30 knots.

### TROPICAL CYCLONE 08S (DELFINA) 30 DEC 2002 - 01 JAN 2003



# Time Intensity for 08S



### Tropical Cyclone (TC) 08S (Delfina)\*



First Poor: 1100Z 30 Dec 02

First Fair : 1200Z 30 Dec 02

First TCFA: N/A

First Warning: 1800Z 30 Dec 02

Last Warning: 0600Z 01 Jan 03, Dissipated

Max Intensity: 55 kts, gusts to 70 kts

Landfall: Near Angoche, Mozambique on 31 December, 2002

Total Warnings: 4

Remarks:

- (1) Tropical Cyclone (TC) 08S developed quickly in the Mozambique Channel and attained a maximum intensity of 55 knots just prior to making landfall in Mozambique. After landfall, the cyclone rapidly weakened. Over land, TC 08S continued to move westward and entered Malawi, entraining hot, desert air and continuing to interact with land. With the low level circulation center still identifiable, TC 08S then looped, headed southeast and re-entered the Mozambique Channel. After re-entering the Mozambique Channel, the cyclone tracked south for 72 hours before dissipating.
- (2) Press reports indicated that TC 08S brought heavy rains and winds to Mozambique, causing a reported 58 fatalities. Reports further indicated that the cyclone left approximately 300,000 persons homeless, damaged crops, and causing infrastructure damage costing \$3.5 million.

|       | Sta        | tistics for JTWC on TC08S |             |
|-------|------------|---------------------------|-------------|
|       |            |                           |             |
| WRN B | BEST TRACK | POSITION ERRORS           | WIND ERRORS |

| DTG      | NO. | LAT   | LONG    | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12  | 24  | 36  | 48 | 72 | 96 | 120 |
|----------|-----|-------|---------|------|----|----|----|----|----|----|----|-----|----|-----|-----|-----|----|----|----|-----|
| 02123012 |     | 16.4S | 43.1E   | 30   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 02123018 | 1   | 16.4S | 42.4E   | 35   | 8  | 56 | 83 | 86 |    |    |    |     | 0  | 10  | 0   | -25 |    |    |    |     |
| 02123106 | 2   | 16.1S | 41.6E   | 35   | 18 | 12 | 17 | 63 |    |    |    |     | 0  | -10 | -15 | -5  |    |    |    |     |
| 02123118 | 3   | 16.0S | 40.4E   | 55   | 6  | 13 | 12 |    |    |    |    |     | 0  | -5  | 0   |     |    |    |    |     |
| 03010106 | 4   | 15.8S | 39.2E   | 45   | 5  | 40 |    |    |    |    |    |     | 0  | 10  |     |     |    |    |    |     |
| 03010112 |     | 15.7S | 38.5E   | 30   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010118 |     | 15.6S | 37.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010200 |     | 15.5S | 36.7E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010206 |     | 15.4S | 35.7E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010212 |     | 15.3S | 35.2E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010218 |     | 15.1S | 35.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010300 |     | 15.1S | 35.7E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010306 |     | 15.1S | 35.9E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010312 |     | 15.1S | 36.1E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010318 |     | 15.0S | 36.3E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010400 |     | 14.9S | 36.7E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010406 |     | 14.9S | 37.1E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010412 |     | 14.8S | 37.5E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010418 |     | 14.8S | 37.9E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010500 |     | 14.7S | 38.3E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010506 |     | 14.8S | 38.8E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010512 |     | 15.1S | 39.2E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010518 |     | 15.4S | 39.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010600 |     | 15.9S | 39.9E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010606 |     | 16.5S | 39.4E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010612 |     | 17.1S | 38.7E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010618 |     | 17.7S | 38.2E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010700 |     | 18.4S | 37.5E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010706 |     | 19.4S | 37.4E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010712 |     | 20.4S | 37.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010718 |     | 21.4S | 37.9E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010800 |     | 22.1S | 38.3E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010806 |     | 22.9S | 38.5E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010812 |     | 23.7S | 38.4E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010818 |     | 24.5S | 38.4E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010900 |     | 25.5S | 38.5E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010906 |     | 26.5S | 38.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
| 03010912 |     | 27.5S | 39.6E   | 25   |    |    |    |    |    |    |    |     |    |     |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 10 | 30 | 37 | 74 |    |    |    |     | 0  | 9   | 5   | 15  |    |    |    |     |
|          |     |       | BIAS    |      |    |    |    |    |    |    |    |     | 0  | 1   | -5  | -15 |    |    |    |     |
|          |     |       | # CASES |      | 4  | 4  | 3  | 2  |    |    |    |     | 4  | 4   | 3   | 2   |    |    |    |     |

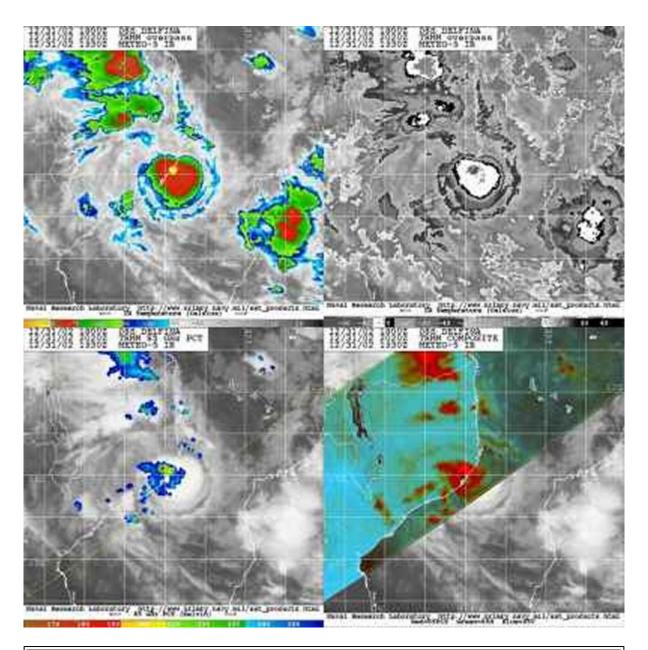


Figure 2-08S-1. 312020Z December 2002 multi-sensor satellite images of TC 08S (Delfina), located in the Mozambique channel, with an estimated intensity of 55 knots.

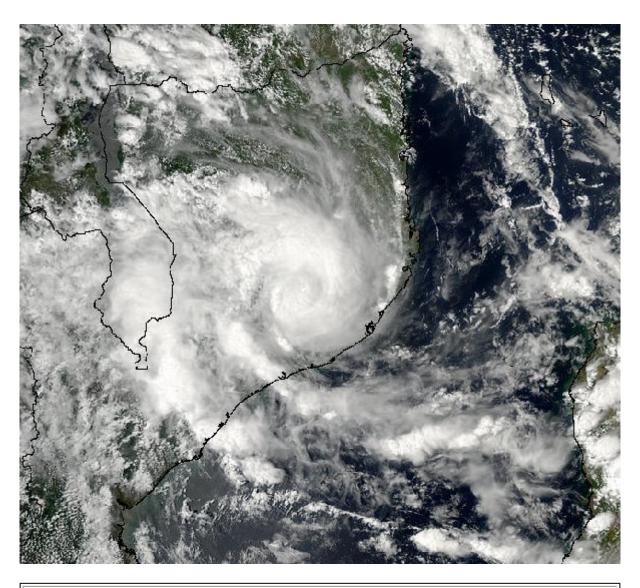
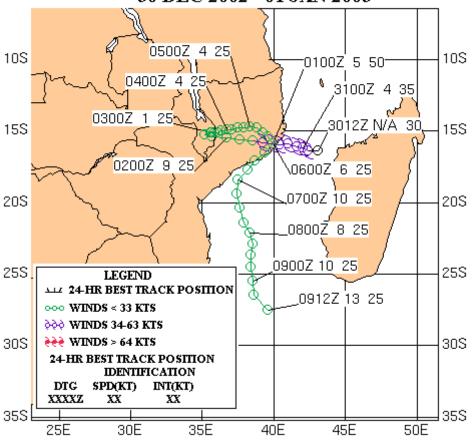
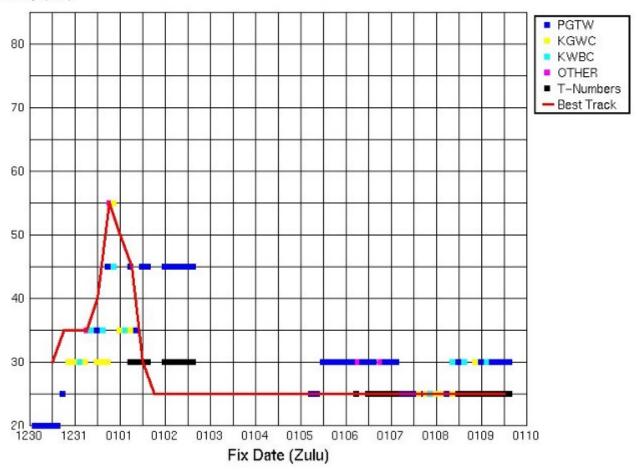


Figure 2-08S-2. 011105Z January 2003 MODIS true-color image of TC 08S (Delfina), located over Mozambique, with an intensity of 30 knots.

#### TROPICAL CYCLONE 08S (DELFINA) 30 DEC 2002 - 01 JAN 2003



# Time Intensity for 08S



# Tropical Cyclone (TC) 09S (Ebula)\*



First Poor: N/A

First Fair: 0600Z 06 Jan 03

First TCFA: 0330Z 07 Jan 03

First Warning: 0000Z 08 Jan 03

Last Warning: 0000Z 12 Jan 03, Extratropical

Max Intensity: 65 kts, gusts to 80 kts

Landfall: None

Total Warnings: 9

Remarks:

(1) Tropical cyclone (TC) 09S developed approximately 115 nm south of Diego Garcia on 06 January 2003. The cyclone initially drifted poleward and slowly intensified to 35 knots, then increased speed as it intensified to 65 knots on 10 January. TC 09S maintained intensify for 48 hours until a mid-latitude frontal system approached from the southwest and TC 09S began extratropical transition. Once TC 09S linked up with the frontal boundary, it weakended rapidly and tracked to the southeast, completing extratropical transition by 12 January at 0000Z, when the final warning was issued.

\*Named by WMO designated RSMC

#### Statistics for JTWC on TC09S

|          | WRN | BEST  | TRACK   |      | PC | SIT | ION | ERR | ORS |    |    |     | WI | ND E | ERR | ORS | 3  |    |    |     |
|----------|-----|-------|---------|------|----|-----|-----|-----|-----|----|----|-----|----|------|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24  | 36  | 48  | 72 | 96 | 120 | 00 | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 03010612 |     | 9.5S  | 71.8E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010618 |     | 9.9S  | 71.5E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010700 |     | 10.4S | 71.5E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010706 |     | 10.8S | 71.2E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010712 |     | 10.9S | 70.7E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010718 |     | 11.1S | 70.2E   | 25   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03010800 | 1   | 11.6S | 70.2E   | 35   | 36 | 76  | 55  | 26  | 29  |    |    |     | 0  | 10   | 0   | 5   | 0  |    |    |     |
| 03010812 | 2   | 12.9S | 70.6E   | 35   | 11 | 53  | 98  | 135 | 143 |    |    |     | 0  | -10  | -5  | -10 | -5 |    |    |     |
| 03010900 | 3   | 14.3S | 70.8E   | 50   | 13 | 76  | 90  | 77  | 46  |    |    |     | 0  | 5    | 5   | 15  | 20 |    |    |     |
| 03010912 | 4   | 15.8S | 71.3E   | 55   | 5  | 35  | 62  | 100 | 122 |    |    |     | -5 | -5   | 5   | 15  | 20 |    |    |     |
| 03011000 | 5   | 17.7S | 70.8E   | 65   | 16 | 59  | 112 | 92  | 88  |    |    |     | 0  | 10   | 5   | 5   | 5  |    |    |     |
| 03011012 | 6   | 20.1S | 70.0E   | 65   | 11 | 24  | 13  | 77  | 190 |    |    |     | 0  | 10   | 10  | 10  | 15 |    |    |     |
| 03011100 | 7   | 23.3S | 69.6E   | 60   | 22 | 44  | 46  | 115 |     |    |    |     | 0  | 5    | 10  | 15  |    |    |    |     |
| 03011112 | 8   | 26.0S | 69.9E   | 50   | 16 | 55  | 85  |     |     |    |    |     | 0  | 0    | 5   |     |    |    |    |     |
| 03011200 | 9   | 27.5S | 71.2E   | 40   | 12 | 41  |     |     |     |    |    |     | 0  | 0    |     |     |    |    |    |     |
| 03011206 |     | 28.1S | 72.0E   | 35   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03011212 |     | 28.4S | 73.1E   | 30   |    |     |     |     |     |    |    |     |    |      |     |     |    |    |    |     |
|          |     |       | AVERAGE |      | 16 | 51  | 70  | 89  | 103 |    |    |     | 1  | 6    | 6   | 11  | 11 |    |    |     |
|          |     |       | BIAS    |      |    |     |     |     |     |    |    |     | -1 | 3    | 4   | 8   | 9  |    |    |     |
|          |     |       | # CASES |      | 9  | 9   | 8   | 7   | 6   |    |    |     | 9  | 9    | 8   | 7   | 6  |    |    |     |

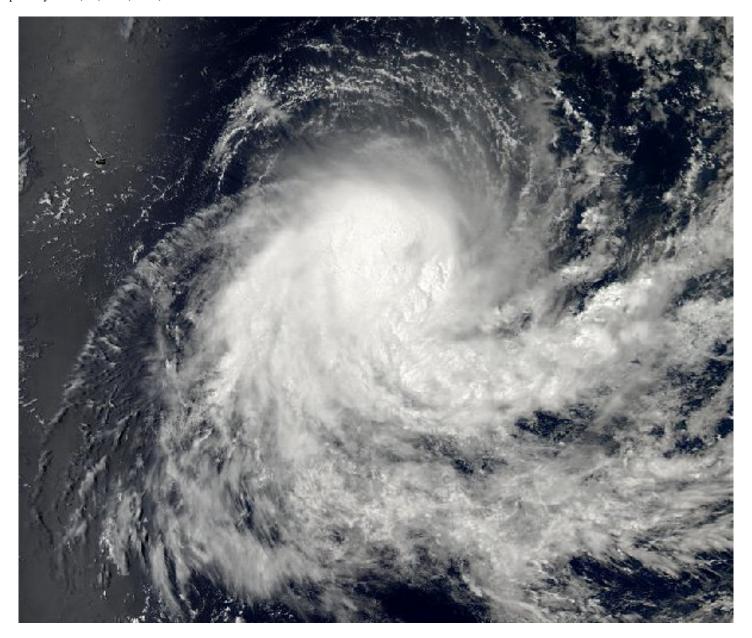


Figure 2-09S-1. 100920Z January 2003 MODIS true-color image of TC 09S (Ebula), located 840nm east of La Reunion, with a maximum intensity of 65 knots.

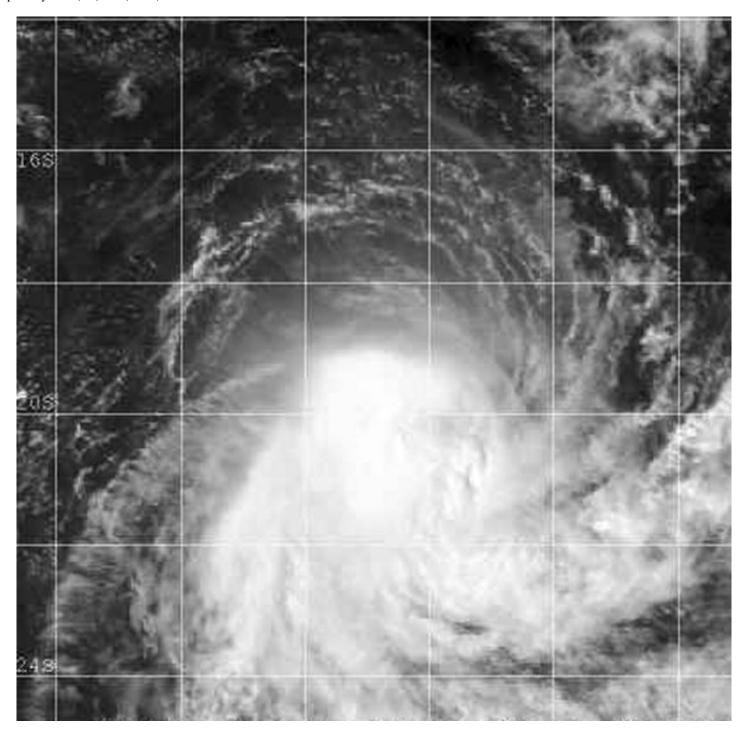
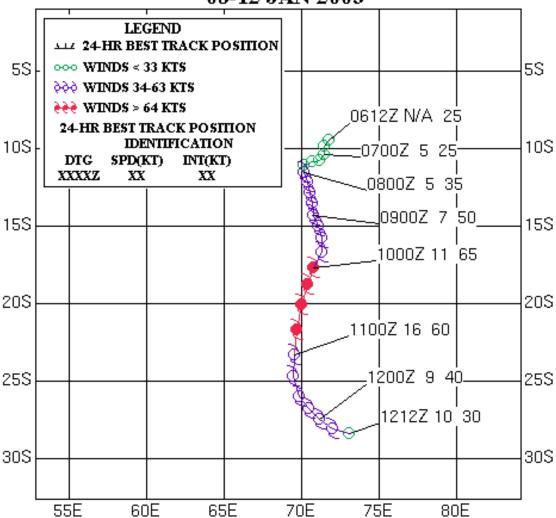
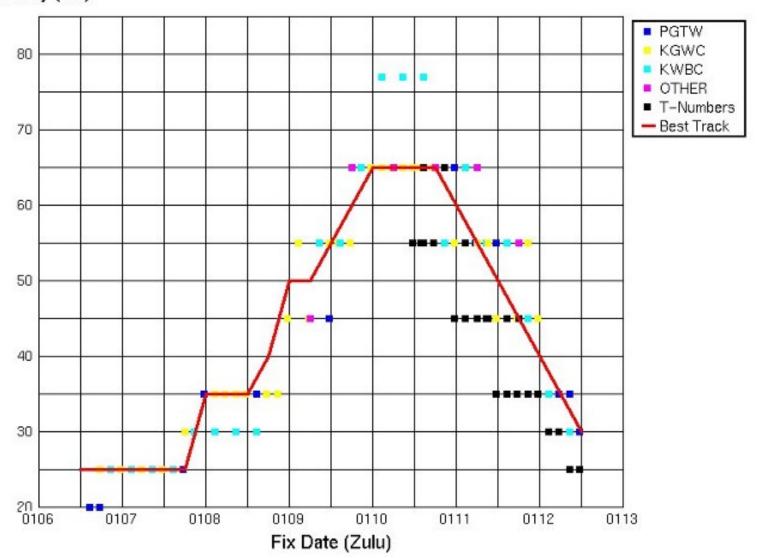


Figure 2-09S-2. 101030Z January 2003 MET-5 visible image of TC 09S (Ebula), 770 nm south of Diego Garcia. The exposed low level circulation center to the north of the deep convection had a peak intensity of 65 knots.

### TROPICAL CYCLONE 09S (EBULA) 08-12 JAN 2003



# Time Intensity for 09S



### Tropical Cyclone (TC) 09S (Ebula)\*



First Poor: N/A

First Fair: 0600Z 06 Jan 03

First TCFA: 0330Z 07 Jan 03

First Warning: 0000Z 08 Jan 03

Last Warning: 0000Z 12 Jan 03, Extratropical

Max Intensity: 65 kts, gusts to 80 kts

Landfall: None

Total Warnings: 9

Remarks:

(1) Tropical cyclone (TC) 09S developed approximately 115 nm south of Diego Garcia on 06 January 2003. The cyclone initially drifted poleward and slowly intensified to 35 knots, then increased speed as it intensified to 65 knots on 10 January. TC 09S maintained intensify for 48 hours until a mid-latitude frontal system approached from the southwest and TC 09S began extratropical transition. Once TC 09S linked up with the frontal boundary, it weakended rapidly and tracked to the southeast, completing extratropical transition by 12 January at 0000Z, when the final warning was issued.

|          |     |       |         | Statis | stic | s fo | or JT | TWC | on 1 | C0 | 98 |     |     |      |     |     |    |    |    |     |
|----------|-----|-------|---------|--------|------|------|-------|-----|------|----|----|-----|-----|------|-----|-----|----|----|----|-----|
|          |     |       |         |        |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
|          | WRN | BEST  | TRACK   |        | PO   | SIT  | ION   | ERR | ORS  |    |    |     | WII | ND E | ERR | ORS | 3  |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind   | 00   | 12   | 24    | 36  | 48   | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 03010612 |     | 9.5S  | 71.8E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010618 |     | 9.9S  | 71.5E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010700 |     | 10.4S | 71.5E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010706 |     | 10.8S | 71.2E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010712 |     | 10.9S | 70.7E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010718 |     | 11.1S | 70.2E   | 25     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03010800 | 1   | 11.6S | 70.2E   | 35     | 36   | 76   | 55    | 26  | 29   |    |    |     | 0   | 10   | 0   | 5   | 0  |    |    |     |
| 03010812 | 2   | 12.9S | 70.6E   | 35     | 11   | 53   | 98    | 135 | 143  |    |    |     | 0   | -10  | -5  | -10 | -5 |    |    |     |
| 03010900 | 3   | 14.3S | 70.8E   | 50     | 13   | 76   | 90    | 77  | 46   |    |    |     | 0   | 5    | 5   | 15  | 20 |    |    |     |
| 03010912 | 4   | 15.8S | 71.3E   | 55     | 5    | 35   | 62    | 100 | 122  |    |    |     | -5  | -5   | 5   | 15  | 20 |    |    |     |
| 03011000 | 5   | 17.7S | 70.8E   | 65     | 16   | 59   | 112   | 92  | 88   |    |    |     | 0   | 10   | 5   | 5   | 5  |    |    |     |
| 03011012 | 6   | 20.1S | 70.0E   | 65     | 11   | 24   | 13    | 77  | 190  |    |    |     | 0   | 10   | 10  | 10  | 15 |    |    |     |
| 03011100 | 7   | 23.3S | 69.6E   | 60     | 22   | 44   | 46    | 115 |      |    |    |     | 0   | 5    | 10  | 15  |    |    |    |     |
| 03011112 | 8   | 26.0S | 69.9E   | 50     | 16   | 55   | 85    |     |      |    |    |     | 0   | 0    | 5   |     |    |    |    |     |
| 03011200 | 9   | 27.5S | 71.2E   | 40     | 12   | 41   |       |     |      |    |    |     | 0   | 0    |     |     |    |    |    |     |
| 03011206 |     | 28.1S | 72.0E   | 35     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
| 03011212 |     | 28.4S | 73.1E   | 30     |      |      |       |     |      |    |    |     |     |      |     |     |    |    |    |     |
|          |     |       | AVERAGE |        | 16   | 51   | 70    | 89  | 103  |    |    |     | 1   | 6    | 6   | 11  | 11 |    |    |     |
|          |     |       | BIAS    |        |      |      |       |     |      |    |    |     | -1  | 3    | 4   | 8   | 9  |    |    |     |
|          |     |       | # CASES |        | 9    | 9    | 8     | 7   | 6    |    |    |     | 9   | 9    | 8   | 7   | 6  |    |    |     |

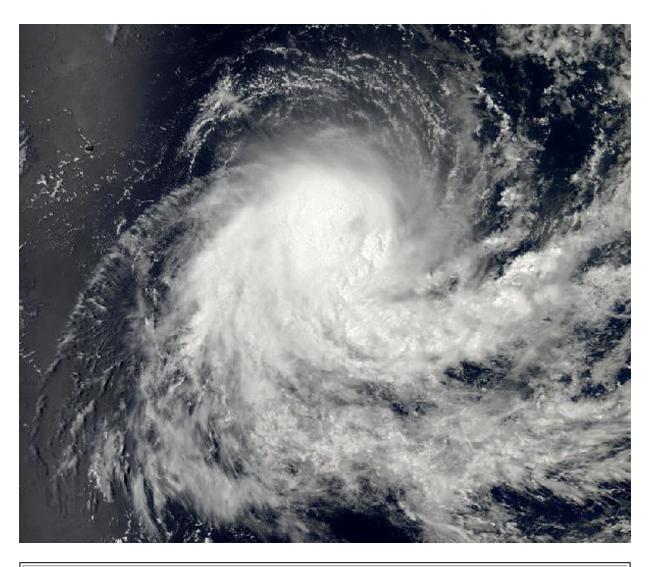


Figure 2-09S-1. 100920Z January 2003 MODIS true-color image of TC 09S (Ebula), located 840nm east of La Reunion, with a maximum intensity of 65 knots.

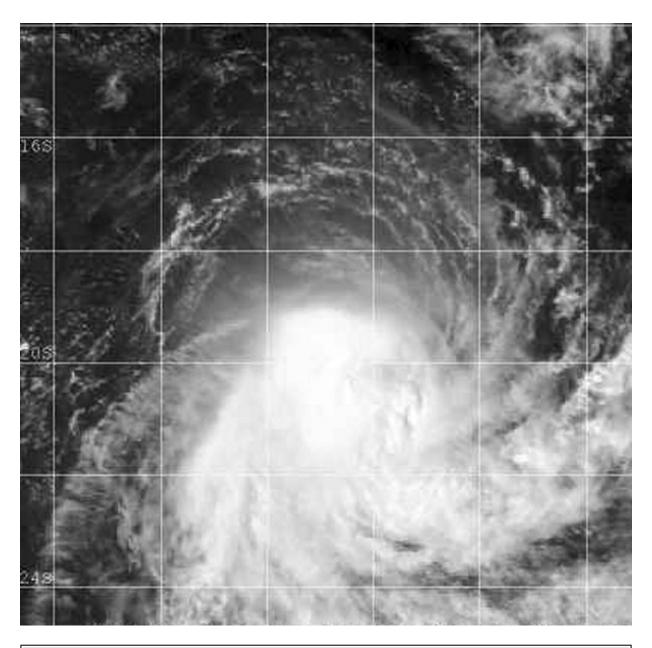
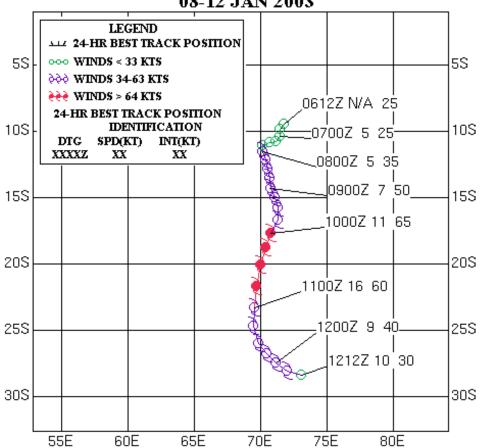


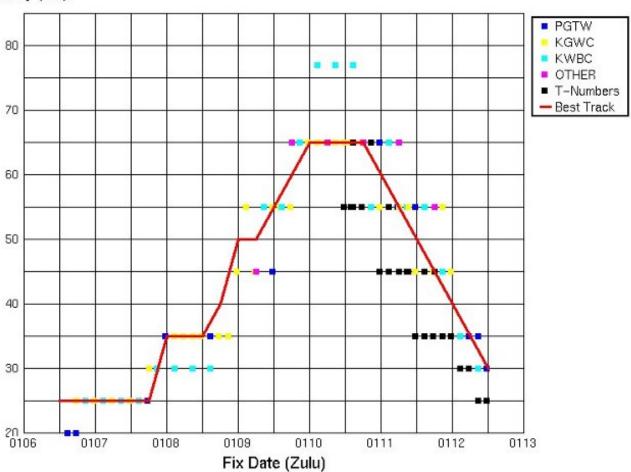
Figure 2-09S-2. 101030Z January 2003 MET-5 visible image of TC 09S (Ebula), 770 nm south of Diego Garcia. The exposed low level circulation center to the north of the deep convection had a peak intensity of 65 knots.

#### TROPICAL CYCLONE 09S (EBULA) 08-12 JAN 2003



# Time Intensity for 09S





## Tropical Cyclone (TC) 10P (Ami)\*



First Poor: N/A

First Fair: 1300Z 10 Jan 03

First TCFA: 0930Z 11 Jan 03

First Warning: 1800Z 11 Jan 03

Last Warning: 0600Z 15 Jan 03

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 8 plus 1 Amended Warning

#### Remarks:

- (1) Tropical Cyclone (TC) 10P developed north of Samoa and the Fiji Islands on 10 January 2003 within the South Pacific Convergence Zone. The cyclone drifted slowly south initially, then began to increase in speed and rapidly intensify, attaining a peak intensity of 110 knots at 0000Z on 14 January. TC 10P passed just east of the Fiji Islands, with an intensity of 95 knots. An approaching frontal boundary then began interacting with the cyclone, causing an increase in track speed and a change in track direction to the southeast as it began extratropical transition. Transition was completed by 0600Z on 15 January while still a 70 knot system at which time the final warning was issued.
- (2) Fiji was reported as having extensive flood damage, with 500 villagers left homeless and two reported fatalities. Storm force winds also caused damage to power lines and buildings.

|          |     |       |         | Stat | isti | cs fo | or J1 | ſWC | on <sup>-</sup> | ΓC1 | 10P |     |    |      |     |     |     |    |    |     |
|----------|-----|-------|---------|------|------|-------|-------|-----|-----------------|-----|-----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |      |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |      | PO   | SITIO | ON E  | RRC | RS              |     |     |     | WI | ND E | ERR | ORS | ;   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind | 00   | 12    | 24    | 36  | 48              | 72  | 96  | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03011012 |     | 9.5S  | 177.6W  | 15   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
| 03011018 |     | 9.6S  | 178.0W  | 15   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
| 03011100 |     | 9.8S  | 178.5W  | 25   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
| 03011106 |     | 10.1S | 179.0W  | 25   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
| 03011112 |     | 10.7S | 179.3W  | 30   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
| 03011118 | 1   | 11.1S | 179.4W  | 35   | 13   | 57    | 83    | 114 | 162             |     |     |     | 0  | 0    | -15 | -25 | -30 |    |    |     |
| 03011206 | 2   | 11.5S | 179.7W  | 45   | 13   | 8     | 30    | 89  | 192             |     |     |     | 0  | -10  | -30 | -45 | -65 |    |    |     |
| 03011218 | 3   | 12.5S | 179.8E  | 65   | 6    | 6     | 31    | 106 | 219             |     |     |     | 0  | -10  | -20 | -55 | -50 |    |    |     |
| 03011306 | 4   | 14.3S | 179.7E  | 85   | 5    | 29    | 64    | 138 | 187             |     |     |     | -5 | -5   | -20 | -20 | -5  |    |    |     |
| 03011318 | 5   | 17.0S | 180.0W  | 95   | 18   | 104   | 176   | 217 |                 |     |     |     | -5 | -20  | -20 | -5  |     |    |    |     |
| 03011400 | 5A  | 19.2S | 179.2W  | 110  | 16   | 24    | 96    | 186 |                 |     |     |     | -5 | -5   | -5  | 0   |     |    |    |     |
| 03011406 | 6   | 21.1S | 177.9W  | 110  | 6    | 35    | 75    |     |                 |     |     |     | 0  | 0    | 15  |     |     |    |    |     |
| 03011418 | 7   | 25.2S | 173.3W  | 100  | 8    | 79    |       |     |                 |     |     |     | 0  | 15   |     |     |     |    |    |     |
| 03011506 | 8   | 28.7S | 166.0W  | 70   | 16   |       |       |     |                 |     |     |     | 0  |      |     |     |     |    |    |     |
| 03011512 |     | 29.0S | 161.7W  | 70   |      |       |       |     |                 |     |     |     |    |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |      | 12   | 43    | 79    | 142 | 190             |     |     |     | 2  | 8    | 18  | 25  | 38  |    |    |     |
|          |     |       | BIAS    |      |      |       |       |     |                 |     |     |     | -2 | -4   | -14 | -25 | -38 |    |    |     |
|          |     |       | # CASES |      | 9    | 8     | 7     | 6   | 4               |     |     |     | 9  | 8    | 7   | 6   | 4   |    |    |     |

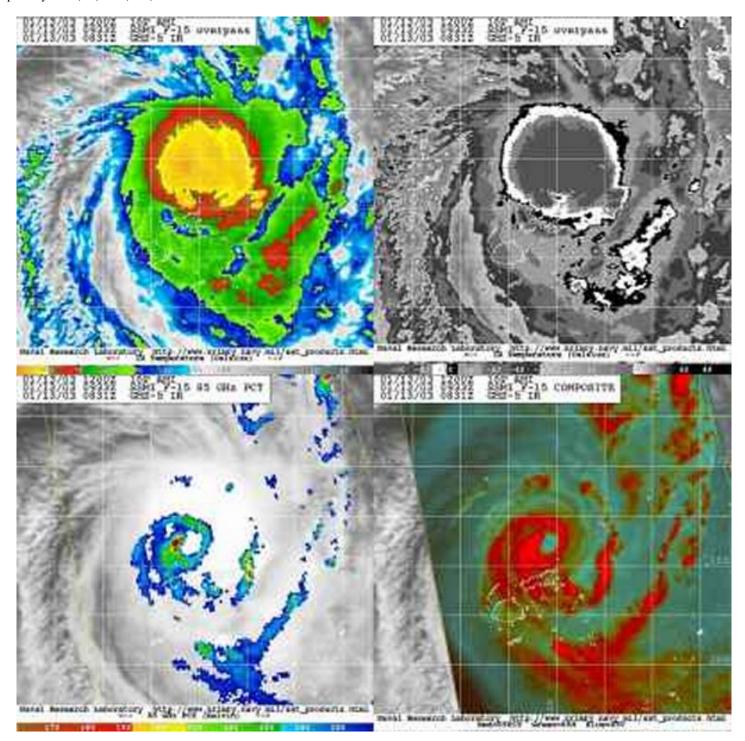


Figure 2-10P-1. 130933Z January 2003 multi-sensor satellite images of TC 10P (Ami), 170 nm northeast of Suva, Fiji. The system had just begun intensification with an estimated intensity of 80 knots.

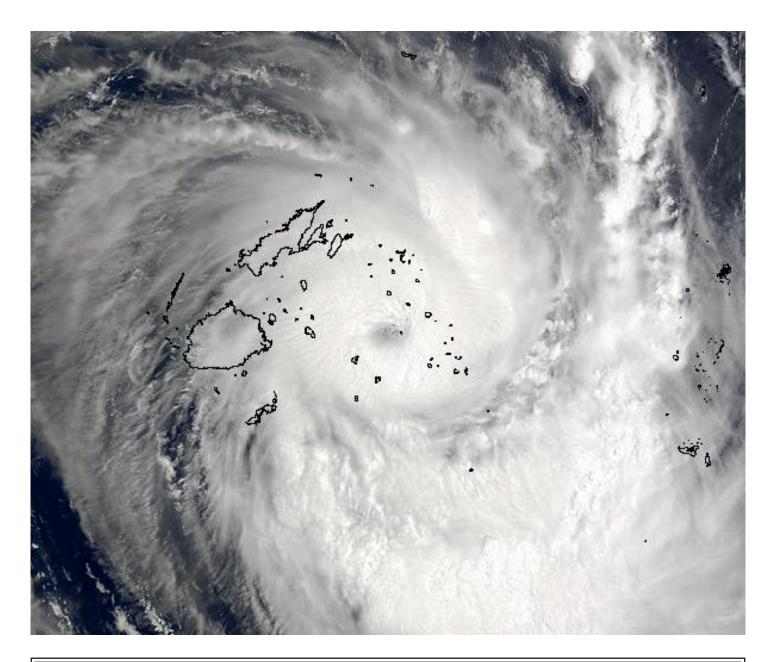


Figure 2-10P-2. 132200Z January 2003 MODIS true-color image of TC 10P (Ami), located over the Fiji Islands, with an intensity of 95 knots.

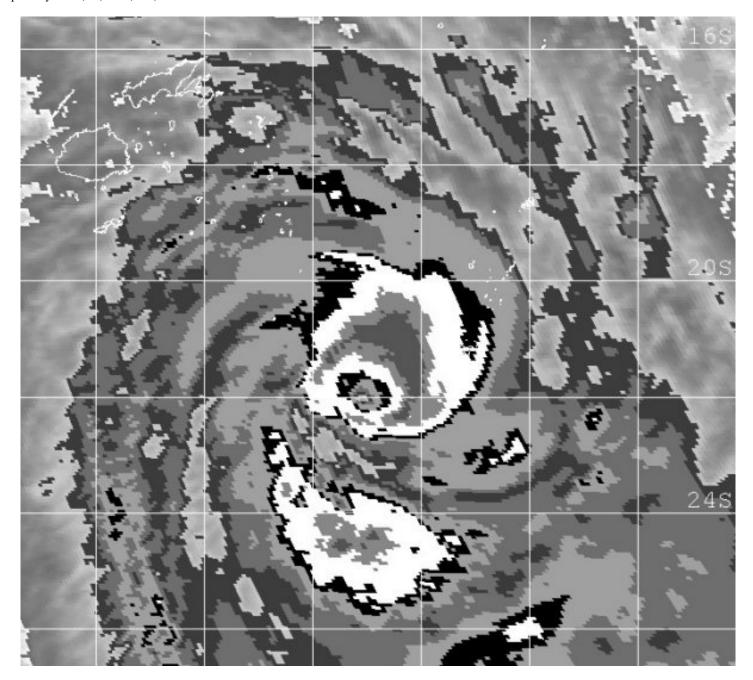
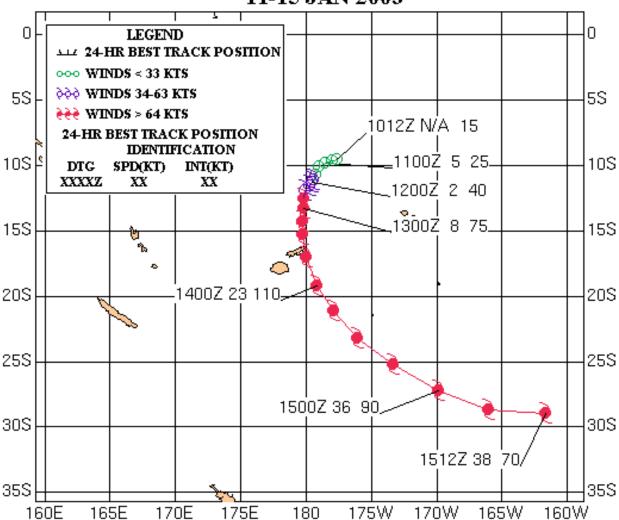
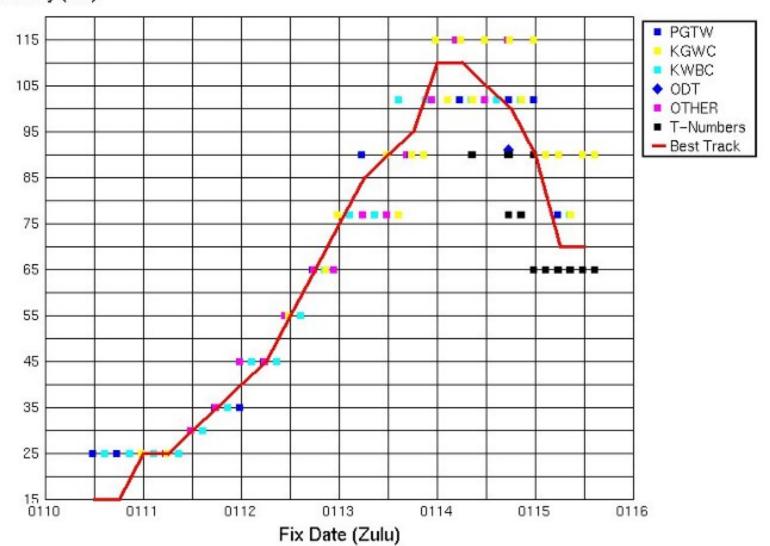


Figure 2-10P-3. 140916Z January 2003 enhanced infrared image of TC 10P (Ami), 150 nm northeast of Suva, Fiji. The system had its peak intensification with estimated intensity of 110 knots.

#### TROPICAL CYCLONE 10P (AMI) 11-15 JAN 2003



# Time Intensity for 10P



### Tropical Cyclone (TC) 10P (Ami)\*



First Poor: N/A

First Fair: 1300Z 10 Jan 03

First TCFA: 0930Z 11 Jan 03

First Warning: 1800Z 11 Jan 03

Last Warning: 0600Z 15 Jan 03

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 8 plus 1 Amended Warning

Remarks:

- (1) Tropical Cyclone (TC) 10P developed north of Samoa and the Fiji Islands on 10 January 2003 within the South Pacific Convergence Zone. The cyclone drifted slowly south initially, then began to increase in speed and rapidly intensify, attaining a peak intensity of 110 knots at 0000Z on 14 January. TC 10P passed just east of the Fiji Islands, with an intensity of 95 knots. An approaching frontal boundary then began interacting with the cyclone, causing an increase in track speed and a change in track direction to the southeast as it began extratropical transition. Transition was completed by 0600Z on 15 January while still a 70 knot system at which time the final warning was issued.
- (2) Fiji was reported as having extensive flood damage, with 500 villagers left homeless and two reported fatalities. Storm force winds also caused damage to power lines and buildings.

|          |     |       |        | Stat | isti | cs fo | or J⊺ | ΓWC | on <sup>-</sup> | TC1 | I0P |             |    |     |     |     |     |    |    |     |  |
|----------|-----|-------|--------|------|------|-------|-------|-----|-----------------|-----|-----|-------------|----|-----|-----|-----|-----|----|----|-----|--|
|          |     |       |        |      |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
|          | WRN | BEST  | TRACK  |      | PO   | SITI  | ON E  | RRC | RS              |     |     | WIND ERRORS |    |     |     |     |     |    |    |     |  |
| DTG      | NO. | LAT   | LONG   | wind | 00   | 12    | 24    | 36  | 48              | 72  | 96  | 120         | 00 | 12  | 24  | 36  | 48  | 72 | 96 | 120 |  |
| 03011012 |     | 9.5S  | 177.6W | 15   |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
| 03011018 |     | 9.6S  | 178.0W | 15   |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
| 03011100 |     | 9.8S  | 178.5W | 25   |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
| 03011106 |     | 10.1S | 179.0W | 25   |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
| 03011112 |     | 10.7S | 179.3W | 30   |      |       |       |     |                 |     |     |             |    |     |     |     |     |    |    |     |  |
| 03011118 | 1   | 11.1S | 179.4W | 35   | 13   | 57    | 83    | 114 | 162             |     |     |             | 0  | 0   | -15 | -25 | -30 |    |    |     |  |
| 03011206 | 2   | 11.5S | 179.7W | 45   | 13   | 8     | 30    | 89  | 192             |     |     |             | 0  | -10 | -30 | -45 | -65 |    |    |     |  |
| 03011218 | 3   | 12.5S | 179.8E | 65   | 6    | 6     | 31    | 106 | 219             |     |     |             | 0  | -10 | -20 | -55 | -50 |    |    |     |  |
| 03011306 | 4   | 14.3S | 179.7E | 85   | 5    | 29    | 64    | 138 | 187             |     |     |             | -5 | -5  | -20 | -20 | -5  |    |    |     |  |
| 03011318 | 5   | 17.0S | 180.0W | 95   | 18   | 104   | 176   | 217 |                 |     |     |             | -5 | -20 | -20 | -5  |     |    |    |     |  |
| 03011400 | 5A  | 19.2S | 179.2W | 110  | 16   | 24    | 96    | 186 |                 |     |     |             | -5 | -5  | -5  | 0   |     |    |    |     |  |
| 03011406 | 6   | 21.1S | 177.9W | 110  | 6    | 35    | 75    |     |                 |     |     |             | 0  | 0   | 15  |     |     |    |    |     |  |

0 15

0

2 8

-2 -4

18 | 25 | 38

-14 -25 -38

6

25.2S 173.3W

28.7S 166.0W

29.0S 161.7W

AVERAGE

# CASES

BIAS

100 8 79

16

12 43

9 8

79

142 190

4

6

70

70

03011418 7

03011506 8

03011512

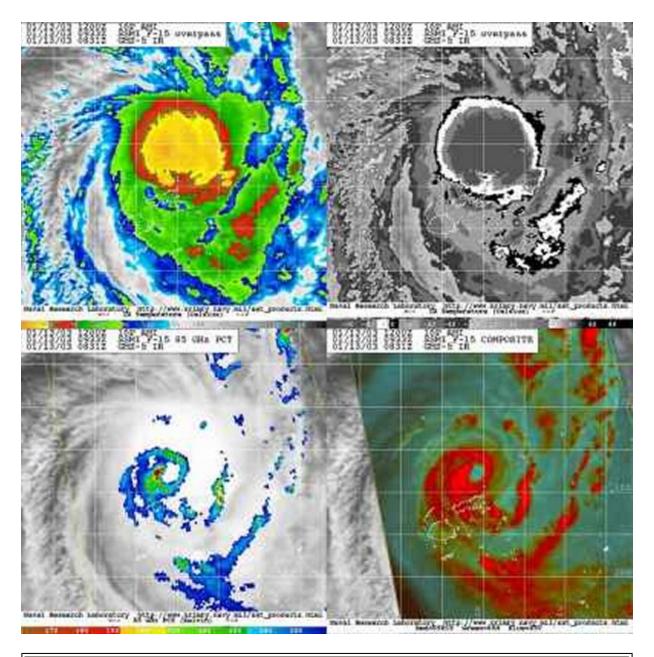


Figure 2-10P-1. 130933Z January 2003 multi-sensor satellite images of TC 10P (Ami), 170 nm northeast of Suva, Fiji. The system had just begun intensification with an estimated intensity of 80 knots.

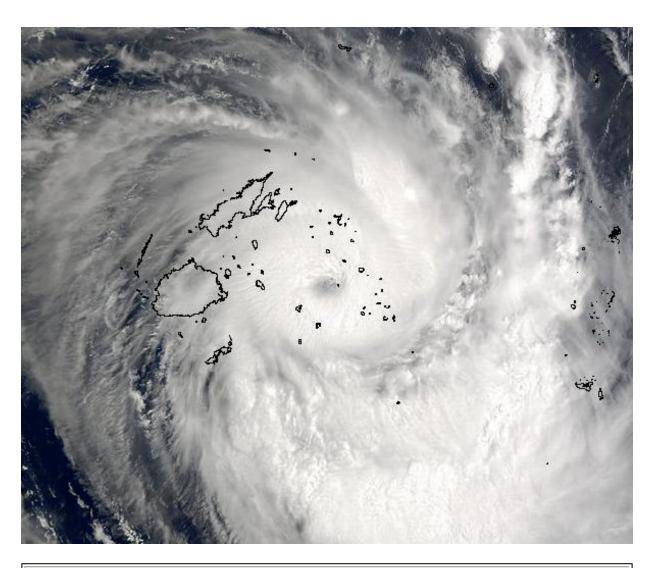


Figure 2-10P-2. 132200Z January 2003 MODIS true-color image of TC 10P (Ami), located over the Fiji Islands, with an intensity of 95 knots.

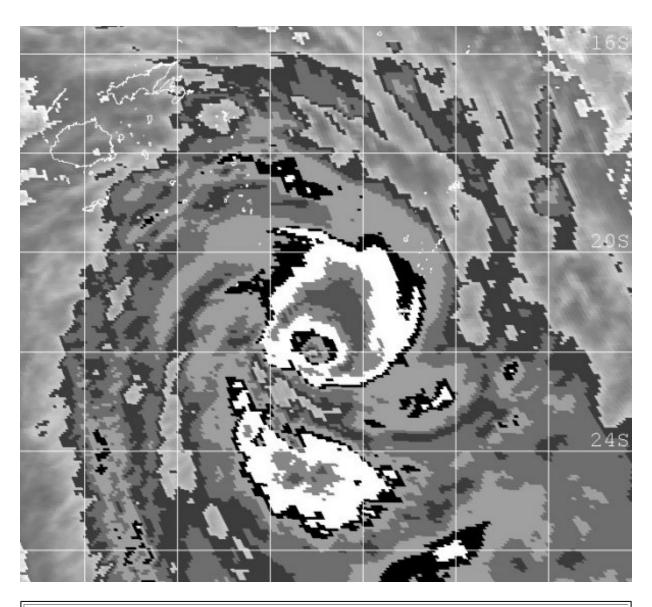
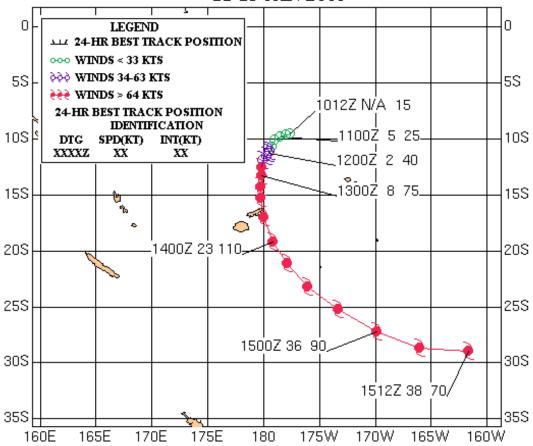
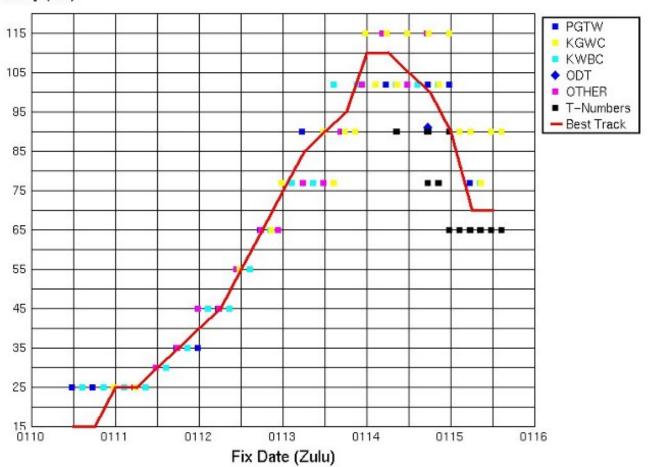


Figure 2-10P-3. 140916Z January 2003 enhanced infrared image of TC 10P (Ami), 150 nm northeast of Suva, Fiji. The system had its peak intensification with estimated intensity of 110 knots.

#### TROPICAL CYCLONE 10P (AMI) 11-15 JAN 2003



## Time Intensity for 10P



## Tropical Cyclone (TC) 11S (Fari)\*



First Poor: 1800Z 20 Jan 03

First Fair: 0500Z 21 Jan 03

First TCFA: 1230Z 23 Jan 03

First Warning: 1800Z 23 Jan 03

Last Warning: 0000Z 31 Jan 03, Dissipated

Max Intensity: 55 kts, gusts to 70 kts

Landfall: None

Total Warnings: 9

Remarks:

(1) Tropical Cyclone (TC) 11S was first described as a tropical disturbance 20 January at 1800Z. Initially, this system did not intensify and was finaled after only one warning. On 27 January, 2003 at 1800Z, another TCFA was issued for TC 11S. Six hours later, on January 28th 2003 at 00Z, JTWC issued the first warning following the second TCFA issuance. The cause of regeneration was due to TC 11S moving under the upper level ridge axis, improving upper level outflow conditions.

Approximately 24 hours after attaining warning status the cyclone made landfall near Mahanoro, Madagascar, with an intensity of 55 knots. After landfall, TC 11S tracked across Madagascar, and then into the Mozambique Channel. The movement of the system was towards the southwest into a weakness in the low to mid-level steering ridge. TC 11S dissipated 48 hours after it tracked back over the South Indian Ocean. Dissipation occurred as the system tracked into an environment of high vertical wind shear.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

|          |     |        |       | Statis | stic | s fo  | r JT\ | WC ( | on T | C1′ | 1S |     |    |      |     |    |    |    |    |     |
|----------|-----|--------|-------|--------|------|-------|-------|------|------|-----|----|-----|----|------|-----|----|----|----|----|-----|
|          |     |        |       |        |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
|          | WRN | BEST 7 | TRACK |        | PC   | SITIO | ON E  | RRO  | RS   |     |    |     | WI | ND E | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT    | LONG  | wind   | 00   | 12    | 24    | 36   | 48   | 72  | 96 | 120 | 00 | 12   | 24  | 36 | 48 | 72 | 96 | 120 |
| 03012100 |     | 11.2S  | 81.0E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012106 |     | 11.6S  | 81.0E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012112 |     | 12.0S  | 81.1E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012118 |     | 12.4S  | 81.1E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012200 |     | 12.7S  | 80.8E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012206 |     | 12.7S  | 80.2E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012212 |     | 13.0S  | 79.6E | 20     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012218 |     | 13.4S  | 78.6E | 30     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012300 |     | 13.8S  | 77.5E | 30     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012306 |     | 14.1S  | 76.5E | 30     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012312 |     | 14.5S  | 75.5E | 30     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03012318 | 1   | 14.9S  | 74.4E | 35     | 8    | 30    | 126   | 327  | 458  |     |    |     | 0  | 25   | 35  | 35 | 30 |    |    |     |
| 03012406 | 2   | 15.2S  | 72.3E | 20     | 30   | 115   |       |      |      |     |    |     | 0  | 0    |     |    |    |    |    |     |
| 03012800 | 3   | 18.6S  | 52.0E | 35     | 16   | 13    | 34    | 135  | 205  |     |    |     | 0  | -5   | -20 | -5 | -5 |    |    |     |
| 03012812 | 4   | 19.6S  | 50.2E | 45     | 0    | 12    | 67    | 152  | 130  |     |    |     | -5 | -10  | 0   | 0  | -5 |    |    |     |
| 03012900 | 5   | 20.3S  | 48.6E | 55     | 0    | 34    | 101   | 67   | 69   |     |    |     | 0  | 0    | 0   | 5  | 10 |    |    |     |
| 03012912 | 6   | 21.1S  | 45.8E | 35     | 30   | 73    | 66    | 30   | 16   |     |    |     | 0  | 0    | 5   | 10 | 10 |    |    |     |
| 03013000 | 7   | 22.4S  | 42.7E | 30     | 13   | 53    | 74    | 109  |      |     |    |     | 0  | 0    | 0   | -5 |    |    |    |     |
| 03013012 | 8   | 24.0S  | 42.2E | 30     | 0    | 48    | 156   |      |      |     |    |     | 0  | 0    | -5  |    |    |    |    |     |
| 03013100 | 9   | 26.3S  | 42.7E | 25     | 31   | 85    | 186   |      |      |     |    |     | 0  | -5   | -5  |    |    |    |    |     |
| 03013106 |     | 27.6S  | 43.2E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03013112 |     | 29.0S  | 43.7E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03013118 |     | 30.5S  | 44.1E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03020100 |     | 31.9S  | 44.7E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03020106 |     | 33.2S  | 45.5E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |
| 03020112 |     | 34.6S  | 47.0E | 25     |      |       |       |      |      |     |    |     |    |      |     |    |    |    |    |     |

| AVERAGE | 1 | 4 5 | 52 | 101 | 137 | 176 |  | 1  | 5 | 9 | 10 | 12 |  |  |
|---------|---|-----|----|-----|-----|-----|--|----|---|---|----|----|--|--|
| BIAS    |   |     |    |     |     |     |  | -1 | 1 | 1 | 7  | 8  |  |  |
| # CASES | 9 | 9   | )  | 8   | 6   | 5   |  | 9  | 9 | 8 | 6  | 5  |  |  |

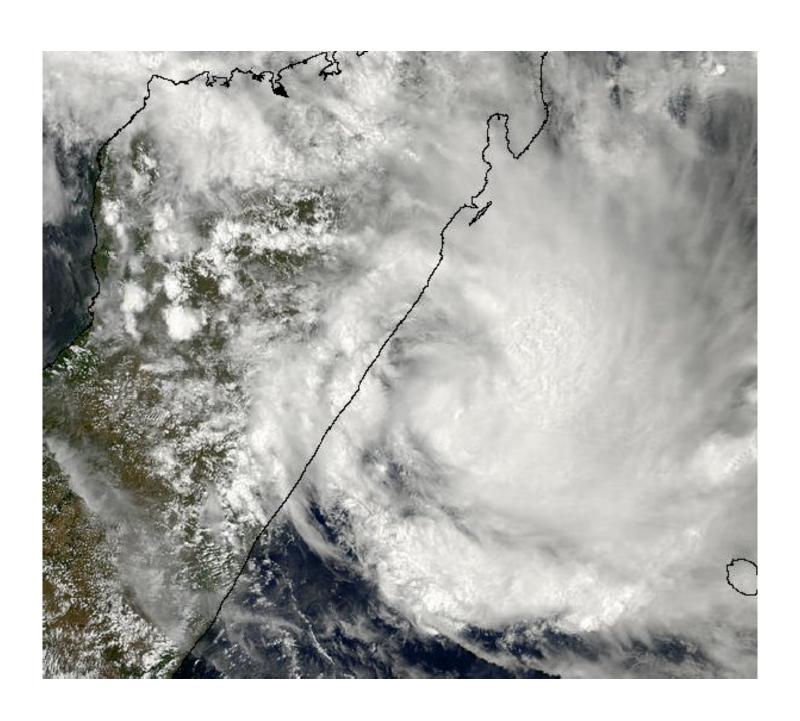


Figure 2-11S-1. 281050Z January 2003 MODIS true-color image of TC 11S (Fari), located 70nm east of Madagascar, with an intensity of 45 knots.

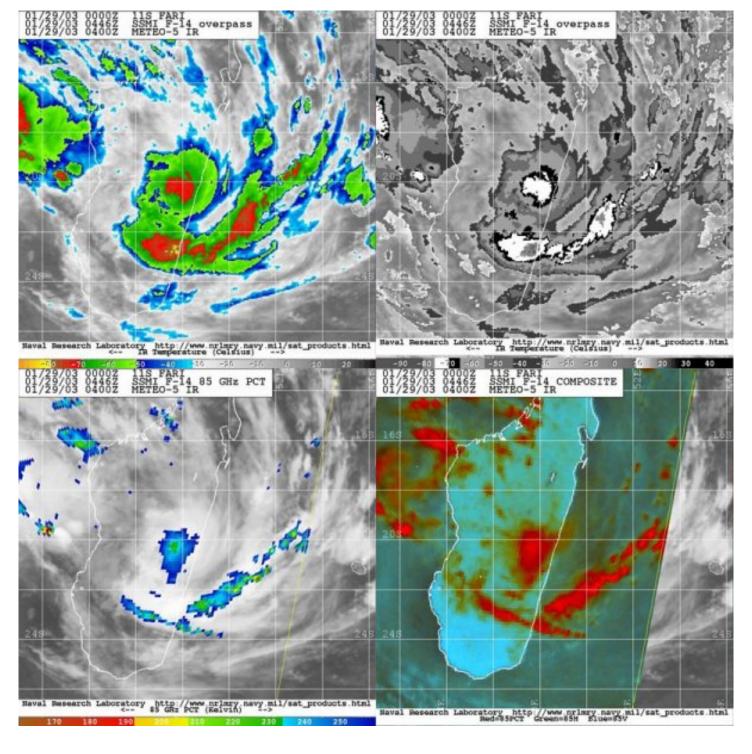
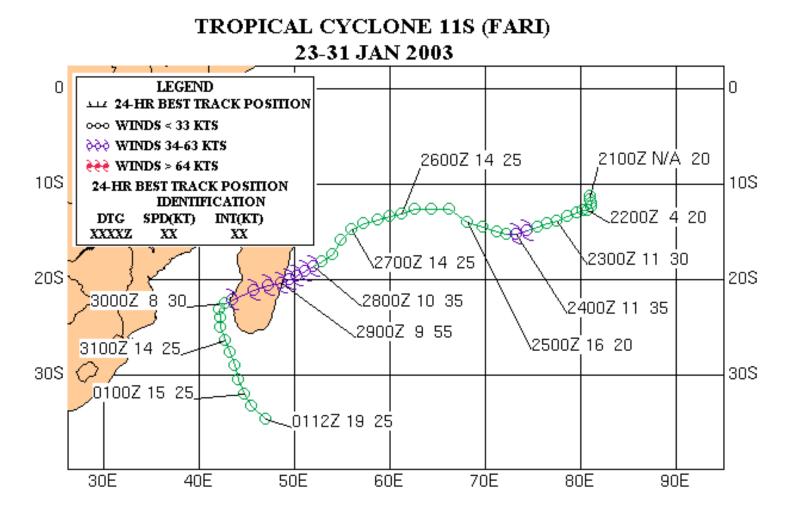
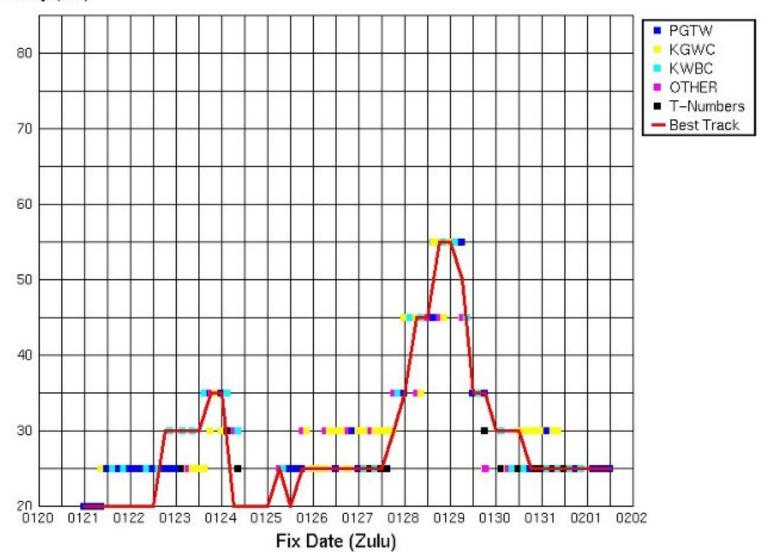


Figure 2-11S-2. 290446Z January 2003 multi-sensor satellite images of TC 11S (Fari), located on the east coast of Madagascar, with a peak intensity of 55 knots.



# Time Intensity for 11S



### **Tropical Cyclone (TC) 11S (Fari)\***



First Poor: 1800Z 20 Jan 03

First Fair: 0500Z 21 Jan 03

First TCFA: 1230Z 23 Jan 03

First Warning: 1800Z 23 Jan 03

Last Warning: 0000Z 31 Jan 03, Dissipated

Max Intensity: 55 kts, gusts to 70 kts

Landfall: None

Total Warnings: 9

Remarks:

(1) Tropical Cyclone (TC) 11S was first described as a tropical disturbance 20 January at 1800Z. Initially, this system did not intensify and was finaled after only one warning. On 27 January, 2003 at 1800Z, another TCFA was issued for TC 11S. Six hours later, on January 28th 2003 at 00Z, JTWC issued the first warning following the second TCFA issuance. The cause of regeneration was due to TC 11S moving under the upper level ridge axis, improving upper level outflow conditions.

Approximately 24 hours after attaining warning status the cyclone made landfall near Mahanoro, Madagascar, with an intensity of 55 knots. After landfall, TC 11S tracked across Madagascar, and then into the Mozambique Channel. The movement of the system was towards the southwest into a weakness in the low to mid-level steering ridge. TC 11S dissipated 48 hours after it tracked back over the South Indian Ocean. Dissipation occurred as the system tracked into an environment of high vertical wind shear.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

| Statistics for JTWC on TC11S |     |       |         |      |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
|------------------------------|-----|-------|---------|------|----|------|------|-----|-----|----|----|-----|----|------|-----|-----|----|----|----|-----|
|                              |     |       |         |      |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
|                              | WRN | BEST  | TRACK   |      | PO | SITI | ON E | RRO | RS  |    |    |     | WI | ND E | ERR | ORS | 3  |    |    |     |
| DTG                          | NO. | LAT   | LONG    | wind | 00 | 12   | 24   | 36  | 48  | 72 | 96 | 120 | 00 | 12   | 24  | 36  | 48 | 72 | 96 | 120 |
| 03012100                     |     | 11.2S | 81.0E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012106                     |     | 11.6S | 81.0E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012112                     |     | 12.0S | 81.1E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012118                     |     | 12.4S | 81.1E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012200                     |     | 12.7S | 80.8E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012206                     |     | 12.7S | 80.2E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012212                     |     | 13.0S | 79.6E   | 20   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012218                     |     | 13.4S | 78.6E   | 30   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012300                     |     | 13.8S | 77.5E   | 30   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012306                     |     | 14.1S | 76.5E   | 30   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012312                     |     | 14.5S | 75.5E   | 30   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03012318                     | 1   | 14.9S | 74.4E   | 35   | 8  | 30   | 126  | 327 | 458 |    |    |     | 0  | 25   | 35  | 35  | 30 |    |    |     |
| 03012406                     | 2   | 15.2S | 72.3E   | 20   | 30 | 115  |      |     |     |    |    |     | 0  | 0    |     |     |    |    |    |     |
| 03012800                     | 3   | 18.6S | 52.0E   | 35   | 16 | 13   | 34   | 135 | 205 |    |    |     | 0  | -5   | -20 | -5  | -5 |    |    |     |
| 03012812                     | 4   | 19.6S | 50.2E   | 45   | 0  | 12   | 67   | 152 | 130 |    |    |     | -5 | -10  | 0   | 0   | -5 |    |    |     |
| 03012900                     | 5   | 20.3S | 48.6E   | 55   | 0  | 34   | 101  | 67  | 69  |    |    |     | 0  | 0    | 0   | 5   | 10 |    |    |     |
| 03012912                     | 6   | 21.1S | 45.8E   | 35   | 30 | 73   | 66   | 30  | 16  |    |    |     | 0  | 0    | 5   | 10  | 10 |    |    |     |
| 03013000                     | 7   | 22.4S | 42.7E   | 30   | 13 | 53   | 74   | 109 |     |    |    |     | 0  | 0    | 0   | -5  |    |    |    |     |
| 03013012                     | 8   | 24.0S | 42.2E   | 30   | 0  | 48   | 156  |     |     |    |    |     | 0  | 0    | -5  |     |    |    |    |     |
| 03013100                     | 9   | 26.3S | 42.7E   | 25   | 31 | 85   | 186  |     |     |    |    |     | 0  | -5   | -5  |     |    |    |    |     |
| 03013106                     |     | 27.6S | 43.2E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03013112                     |     | 29.0S | 43.7E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03013118                     |     | 30.5S | 44.1E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03020100                     |     | 31.9S | 44.7E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03020106                     |     | 33.2S | 45.5E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
| 03020112                     |     | 34.6S | 47.0E   | 25   |    |      |      |     |     |    |    |     |    |      |     |     |    |    |    |     |
|                              |     |       | AVERAGE |      | 14 | 52   | 101  | 137 | 176 |    |    |     | 1  | 5    | 9   | 10  | 12 |    |    |     |

-1 1

9 9

8

8

6 5

BIAS

# CASES

9 9

8

6

5

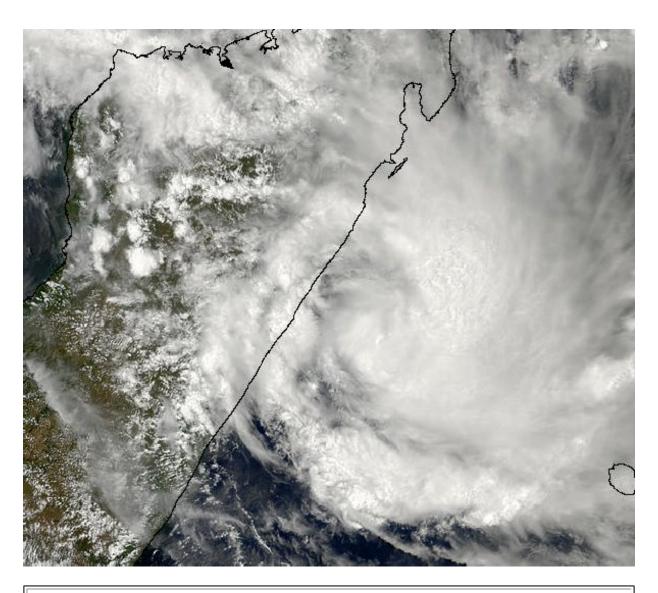


Figure 2-11S-1. 281050Z January 2003 MODIS true-color image of TC 11S (Fari), located 70nm east of Madagascar, with an intensity of 45 knots.

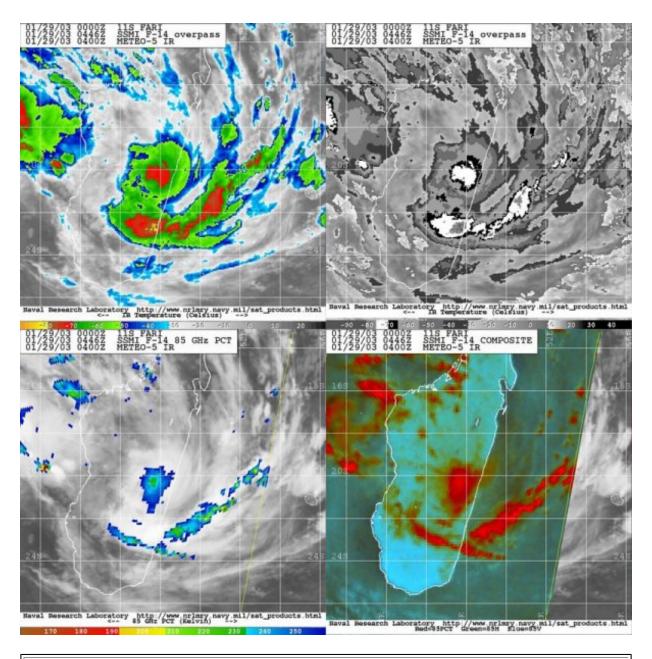
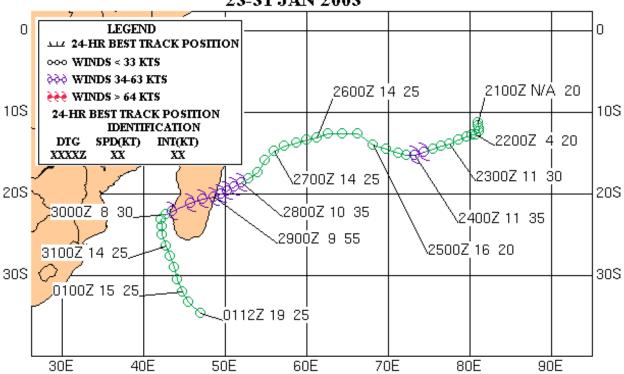
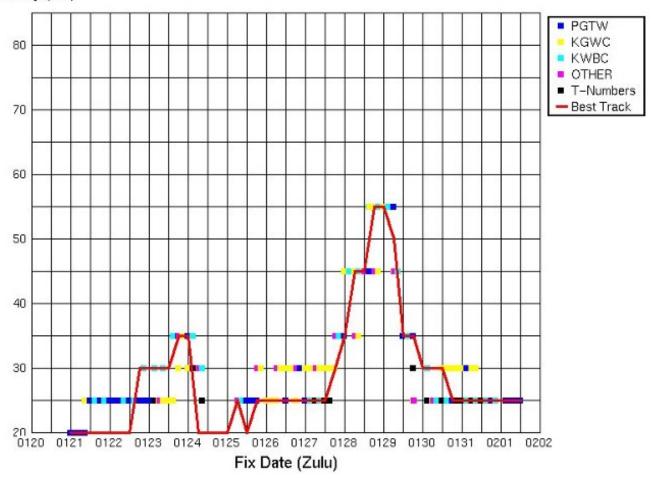


Figure 2-11S-2. 290446Z January 2003 multi-sensor satellite images of TC 11S (Fari), located on the east coast of Madagascar, with a peak intensity of 55 knots.

#### TROPICAL CYCLONE 11S (FARI) 23-31 JAN 2003



## Time Intensity for 11S



## Tropical Cyclone (TC) 12P (Beni)\*



First Poor: N/A

First Fair: 1900Z 24 Jan 03

First TCFA: 2100Z 24 Jan 03

First Warning: 0000Z 25 Jan 03

Last Warning: 1200Z 31 Jan 03, Dissipation

Max Intensity: 125 kts, gusts to 150 kts

Landfall: None

Total Warnings: 14

Remarks:

(1) Tropical Cyclone (TC) 12P was initially described as a tropical disturbance north of Fiji on 24 January, 2003. Approximately 6 hours later, on 25 January at 0000Z, JTWC issued the first warning on this cyclone. Initial warning issuance occurred while the system was intensifying at a climatological rate and moving slowly west-southwest along the northwestern periphery of the low to mid level subtropical ridge.

TC 12P began to track southeastward along the western periphery of the steering ridge. At 0000Z on 29 January, TC 12P reached its peak intensification of 125 knots as it encountered a favorable environment of weak vertical wind shear and good outflow aloft. TC 12P then began to track southwestward as the system started its downward intensity trend and weakened.

Rapid dissipation started at approximately 1200Z on 30 January due to TC 12P tracking into an environment of high vertical wind shear and decreasing outflow aloft.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

|          |     |        |        | Stati | stic | s f | or J | ΓWC | on  | TC | 12P |     |     |      |     |     |     |    |    |     |
|----------|-----|--------|--------|-------|------|-----|------|-----|-----|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |        |        |       |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST 1 | ΓRACK  |       | PO   | SIT | ION  | ERR | ORS |    |     |     | WII | ND E | ERR | ORS | ;   |    | ,  |     |
| DTG      | NO. | LAT    | LONG   | wind  | 00   | 12  | 24   | 36  | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03012412 |     | 12.9S  | 162.0E | 20    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03012418 |     | 13.0S  | 161.7E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03012500 | 1   | 13.1S  | 161.4E | 30    | 6    | 17  | 57   | 71  | 67  |    |     |     | 5   | 10   | 15  | 15  | 20  |    |    |     |
| 03012512 | 2   | 12.9S  | 160.9E | 35    | 26   | 88  | 130  | 126 | 105 |    |     |     | 0   | 5    | 0   | 5   | 15  |    |    |     |
| 03012600 | 3   | 12.4S  | 161.0E | 40    | 11   | 21  | 46   | 38  | 42  |    |     |     | 0   | 0    | 5   | 20  | 5   |    |    |     |
| 03012612 | 4   | 12.7S  | 161.3E | 50    | 5    | 6   | 29   | 27  | 12  |    |     |     | 0   | 5    | 10  | -5  | -10 |    |    |     |
| 03012700 | 5   | 13.0S  | 160.8E | 55    | 18   | 50  | 71   | 72  | 81  |    |     |     | 5   | 15   | 5   | -5  | -35 |    |    |     |
| 03012712 | 6   | 13.8S  | 160.8E | 55    | 13   | 35  | 24   | 30  | 99  |    |     |     | 5   | -10  | -20 | -55 | -50 |    |    |     |
| 03012800 | 7   | 14.7S  | 160.7E | 75    | 5    | 17  | 58   | 106 | 186 |    |     |     | 0   | -10  | -45 | -40 | -20 |    |    |     |
| 03012812 | 8   | 15.6S  | 161.1E | 90    | 5    | 58  | 124  | 210 | 263 |    |     |     | -5  | -40  | -30 | -5  | 30  |    |    |     |
| 03012900 | 9   | 16.5S  | 162.7E | 125   | 8    | 60  | 144  | 190 | 147 |    |     |     | 0   | 5    | 20  | 45  | 70  |    |    |     |
| 03012912 | 10  | 17.8S  | 164.9E | 125   | 5    | 46  | 116  | 73  | 45  |    |     |     | 0   | 15   | 35  | 60  | 60  |    |    |     |
| 03013000 | 11  | 19.1S  | 167.7E | 105   | 6    | 29  | 35   | 140 | 244 |    |     |     | 10  | 30   | 60  | 65  | 65  |    |    |     |
| 03013012 | 12  | 20.8S  | 169.3E | 75    | 16   | 62  | 167  | 290 | 331 |    |     |     | 0   | 25   | 30  | 30  | 20  |    |    |     |
| 03013100 | 13  | 22.3S  | 168.0E | 40    | 13   | 85  | 143  | 160 | 139 |    |     |     | 0   | 0    | 0   | 0   | -5  |    |    |     |
| 03013112 | 14  | 24.1S  | 165.2E | 30    | 42   | 90  |      |     |     |    |     |     | -5  | -5   |     |     |     |    |    |     |
| 03013118 |     | 24.3S  | 163.1E | 30    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020100 |     | 23.8S  | 161.7E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020106 |     | 23.4S  | 160.6E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020112 |     | 23.1S  | 159.6E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020118 |     | 22.6S  | 158.7E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020200 |     | 22.3S  | 158.0E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020206 |     | 22.0S  | 157.4E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020212 |     | 21.5S  | 156.6E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020218 |     | 21.1S  | 155.8E | 25    |      |     |      |     |     |    |     |     |     |      |     |     |     |    |    |     |

| 03020300 | 20.9S | 154.7E  | 25 |    |    |    |     |     |  |    |    |    |    |    |  |  |
|----------|-------|---------|----|----|----|----|-----|-----|--|----|----|----|----|----|--|--|
| 03020306 | 20.5S | 153.7E  | 25 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020312 | 20.3S | 153.2E  | 25 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020318 | 20.5S | 152.7E  | 25 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020400 | 20.7S | 152.1E  | 20 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020406 | 20.6S | 151.3E  | 20 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020412 | 20.2S | 150.6E  | 20 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020418 | 19.9S | 150.2E  | 20 |    |    |    |     |     |  |    |    |    |    |    |  |  |
| 03020500 | 20.1S | 149.7E  | 20 |    |    |    |     |     |  |    |    |    |    |    |  |  |
|          |       | AVERAGE |    | 13 | 47 | 88 | 118 | 135 |  | 3  | 13 | 21 | 27 | 31 |  |  |
|          |       | BIAS    |    |    |    |    |     |     |  | 1  | 3  | 7  | 10 | 13 |  |  |
|          |       | # CASES |    | 14 | 14 | 13 | 13  | 13  |  | 14 | 14 | 13 | 13 | 13 |  |  |

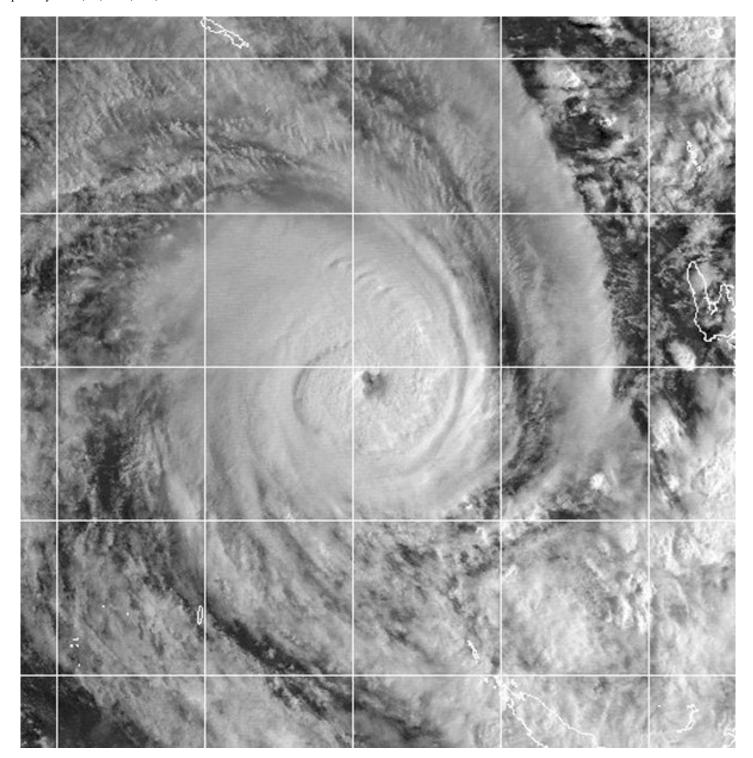


Figure 2-12P-1. 282112Z January 2003 GMS-5 visible imagery of TC 12P (Beni), 160 nm north of New Caledonia, with a peak intensity of 125 knots.

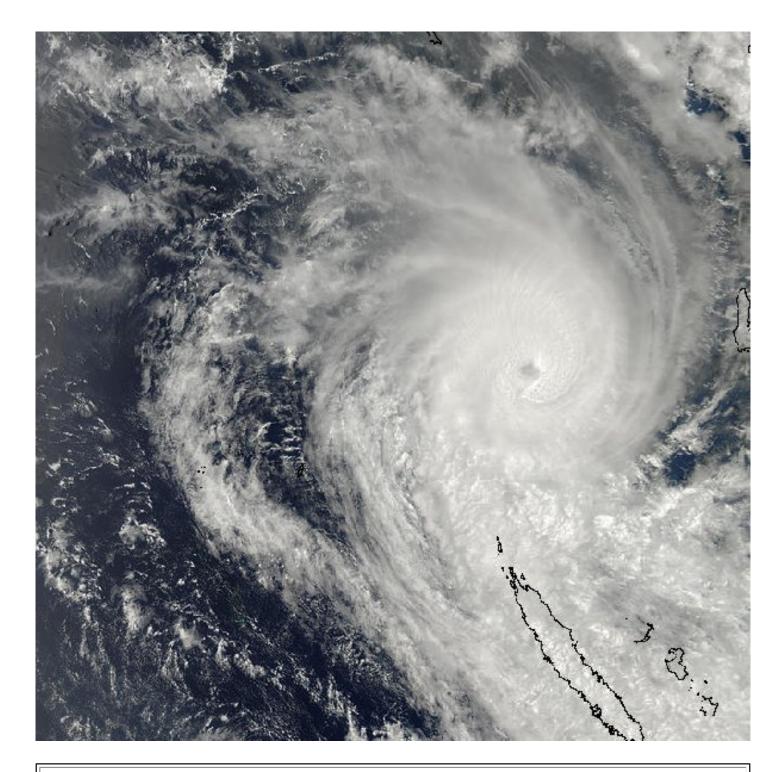


Figure 2-12P-2. 290315Z January 2003 MODIS true-color image of TC 12P (Beni), located 190nm north of New Caledonia, with a maximum intensity of 125 knots.

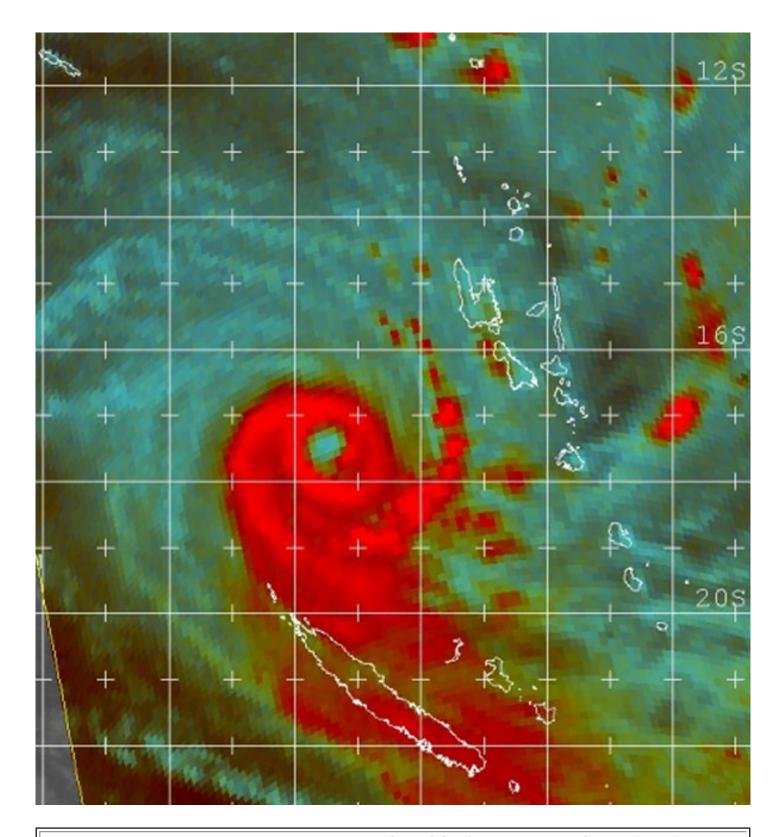
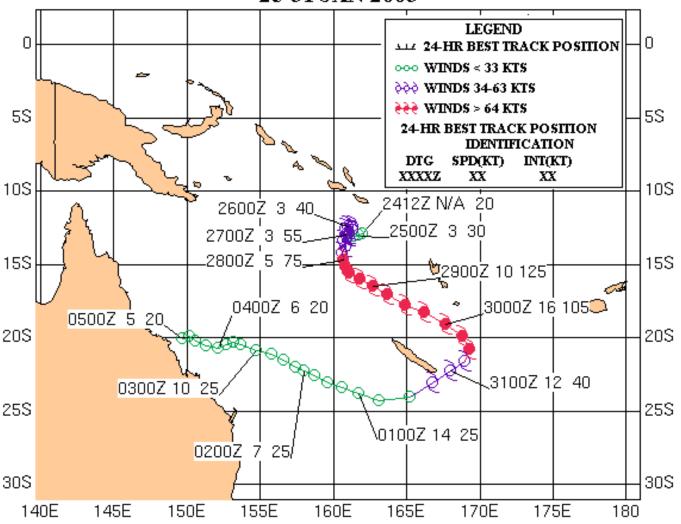
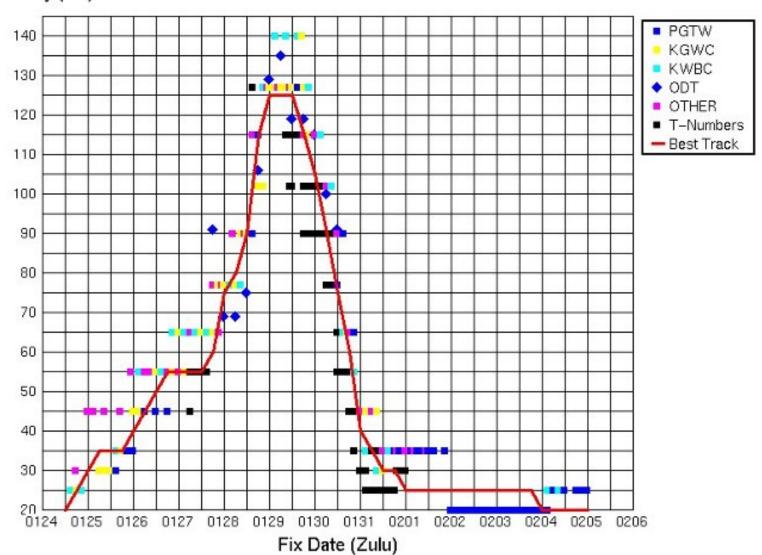


Figure 2-12P-3. 291034Z January 2003 85 GHz SSM/I imagery of TC 12P (Beni), 180 nm north of New Caledonia, with a peak intensity of 125 knots.

#### TROPICAL CYCLONE 12P (BENI) 25-31 JAN 2003



## Time Intensity for 12P



## Tropical Cyclone (TC) 12P (Beni)\*



First Poor: N/A

First Fair: 1900Z 24 Jan 03

First TCFA: 2100Z 24 Jan 03

First Warning: 0000Z 25 Jan 03

Last Warning: 1200Z 31 Jan 03, Dissipation

Max Intensity: 125 kts, gusts to 150 kts

Landfall: None

Total Warnings: 14

Remarks:

(1) Tropical Cyclone (TC) 12P was initially described as a tropical disturbance north of Fiji on 24 January, 2003. Approximately 6 hours later, on 25 January at 0000Z, JTWC issued the first warning on this cyclone. Initial warning issuance occurred while the system was intensifying at a climatological rate and moving slowly west-southwest along the northwestern periphery of the low to mid level subtropical ridge.

TC 12P began to track southeastward along the western periphery of the steering ridge. At 0000Z on 29 January, TC 12P reached its peak intensification of 125 knots as it encountered a favorable environment of weak vertical wind shear and good outflow aloft. TC 12P then began to track southwestward as the system started its downward intensity trend and weakened.

Rapid dissipation started at approximately 1200Z on 30 January due to TC 12P tracking into an environment of high vertical wind shear and decreasing outflow aloft.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

#### Statistics for JTWC on TC12P WRN BEST TRACK POSITION ERRORS WIND ERRORS DTG NO. LAT wind 00 12 24 72 96 120 00 12 24 36 48 72 96 120 LONG 36 48 12.9S 162.0E 20 03012412 13.0S 161.7E 03012418 25 03012500 1 13.1S 161.4E 30 17 57 71 67 15 20 6 5 10 15 03012512 2 15 12.9S | 160.9E 35 26 | 88 | 130 | 126 | 105 0 5 0 5 03012600 3 12.4S | 161.0E 40 11 21 46 42 38 5 20 5 03012612 4 12.7S | 161.3E 50 29 27 10 -10 5 6 12 0 5 -5 03012700 5 13.0S | 160.8E 55 18 50 71 72 81 5 15 5 -5 -35 03012712 6 13.8S | 160.8E 55 13 35 24 30 99 5 -10 -20 -55 | -50 03012800 7 14.7S | 160.7E 75 5 17 58 106 186 0 -10 -45 -40 -20 03012812 8 15.6S | 161.1E 90 5 58 124 210 263 -5 -40 -30 30 -5 03012900 9 16.5S | 162.7E 125 8 60 144 190 147 5 20 45 70 03012912 10 17.8S 164.9E 125 |5 46 116 73 45 0 15 35 60 60 03013000 11 19.1S | 167.7E 105 6 29 35 140 244 10 30 60 65 65 03013012 12 20.8S | 169.3E 75 16 62 167 290 331 0 25 30 30 20 03013100 13 22.3S 168.0E 40 13 85 143 160 139 0 0 0 0 -5 03013112 14 24.1S 165.2E 30 42 90 -5 -5 24.3S 163.1E 03013118 30 03020100 23.8S 161.7E 25 23.4S 160.6E 03020106 25 23.1S 159.6E 25 03020112 03020118 22.6S 158.7E 25 03020200 22.3S 158.0E 25 03020206 22.0S 157.4E 25 03020212 21.5S | 156.6E 25 03020218 21.1S 155.8E 25 03020300 20.9S 154.7E 25 03020306 20.5S 153.7E 25 03020312 20.3S 153.2E 25 03020318 20.5S 152.7E 25 03020400 20.7S | 152.1E 20 03020406 20.6S 151.3E 20 03020412 20.2S 150.6E 20 03020418 19.9S 150.2E 20 03020500 20.1S 149.7E 20 **AVERAGE** 13 47 88 118 135 3 13 21 27 31 **BIAS** 1 3 7 10 13 # CASES 14 14 13 13 13 14 14 13 13 13

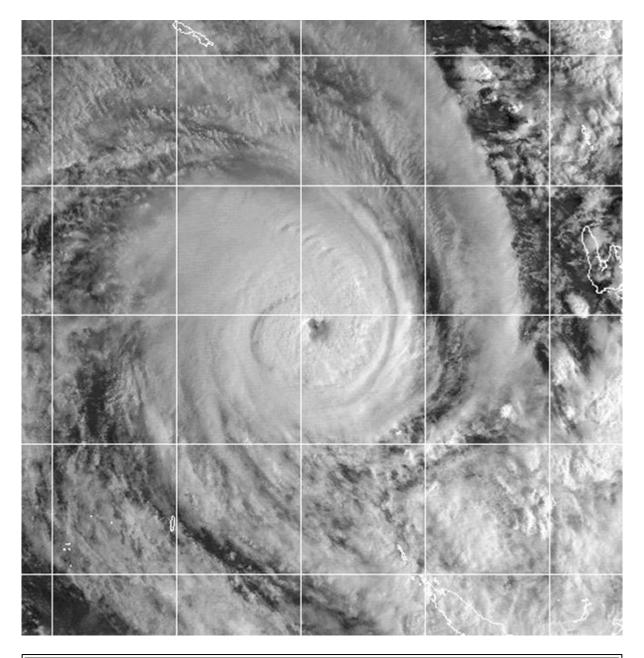


Figure 2-12P-1. 282112Z January 2003 GMS-5 visible imagery of TC 12P (Beni), 160 nm north of New Caledonia, with a peak intensity of 125 knots.

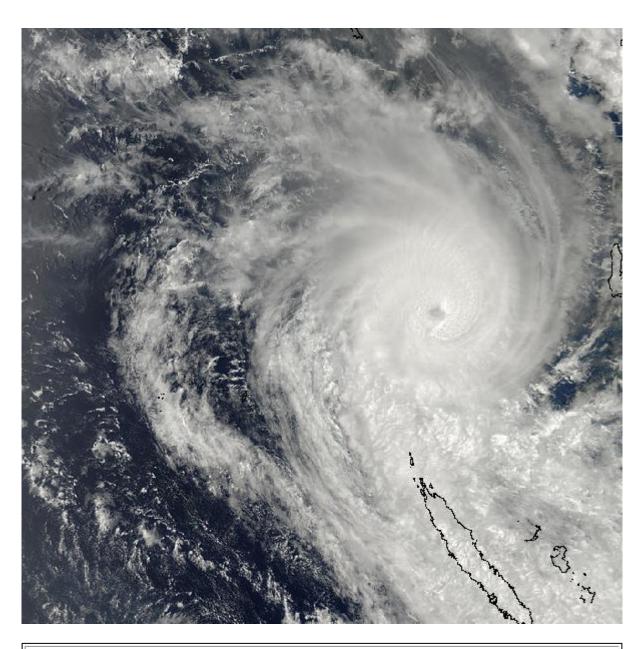


Figure 2-12P-2. 290315Z January 2003 MODIS true-color image of TC 12P (Beni), located 190nm north of New Caledonia, with a maximum intensity of 125 knots.

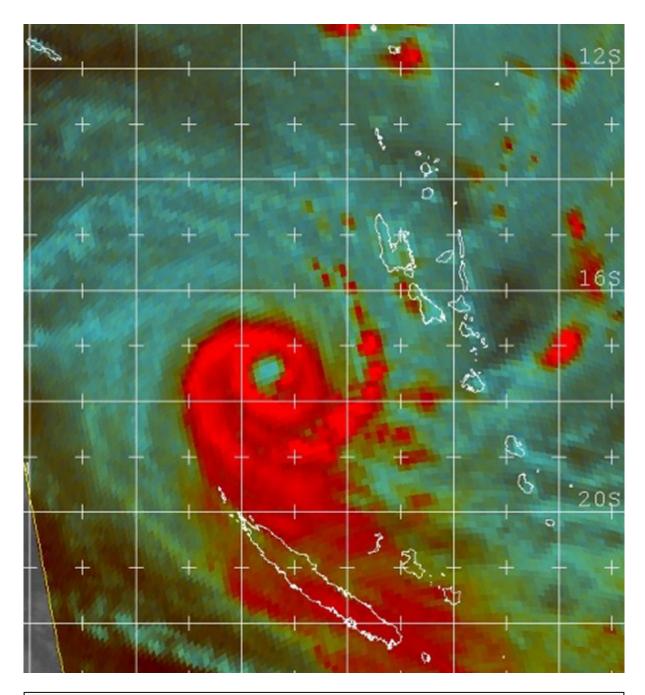
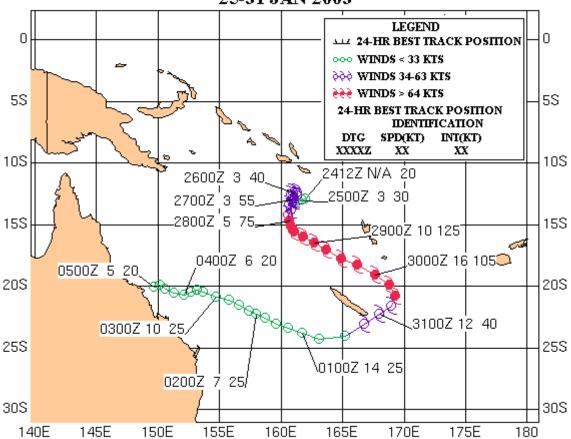
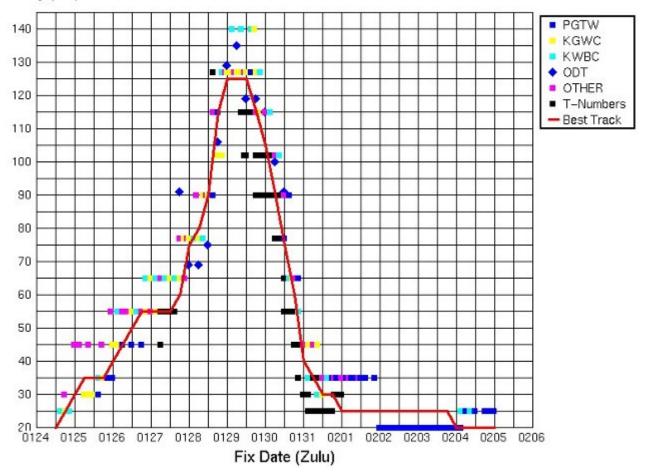


Figure 2-12P-3. 291034Z January 2003 85 GHz SSM/I imagery of TC 12P (Beni), 180 nm north of New Caledonia, with a peak intensity of 125 knots.

#### TROPICAL CYCLONE 12P (BENI) 25-31 JAN 2003



## Time Intensity for 12P



## **Tropical Cyclone (TC) 13P (Cilla)\***



First Poor: 0600Z 25 Jan 03

First Fair: 1900Z 25 Jan 03

First TCFA: 1300Z 26 Jan 03

First Warning: 0600Z 27 Jan 03

Last Warning: 1800Z 27 Jan 03, Extratropical

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 2 + 1 Amended Warning

Remarks:

(1) Tropical Cyclone (TC) 13P developed in a broad monsoon trough on 25 January, 2003 approximately 380 nm west-northwest of Suva, Fiji and tracked eastward for one day and then southeastward over the next 5 days. The first warning was issued on the 27th of January at 0600Z with the final warning being issued as an amendment just 13 hours later. No operational impacts and no damage was reported.

\*Named by WMO designated RSMC

| 01-11-1    | P -7 A A 4 | <b>^</b>               |       |
|------------|------------|------------------------|-------|
| Statistics |            | $\Gamma$ $\sim$ $\sim$ | TC13P |
|            | · · · ·    |                        |       |
|            |            |                        |       |

WRN BEST TRACK POSITION ERRORS WIND ERRORS

| DTG      | NO. | LAT   | LONG    | wind | 00 | 12 | 24  | 36  | 48 | 72 | 96 | 120 | 00 | 12  | 24 | 36 | 48 | 72 | 96 | 120 |
|----------|-----|-------|---------|------|----|----|-----|-----|----|----|----|-----|----|-----|----|----|----|----|----|-----|
| 03012506 |     | 15.5S | 172.6E  | 20   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012512 |     | 15.3S | 173.6E  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012518 |     | 15.2S | 174.8E  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012600 |     | 15.2S | 176.0E  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012606 |     | 15.6S | 177.3E  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012612 |     | 16.1S | 178.6E  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012618 |     | 16.8S | 180.0W  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012700 |     | 17.7S | 178.1W  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012706 | 1   | 19.0S | 176.7W  | 35   | 5  | 90 | 141 | 171 |    |    |    |     | 0  | 0   | 0  | -5 |    |    |    |     |
| 03012718 | 2   | 20.0S | 173.1W  | 35   | 0  | 92 |     |     |    |    |    |     | 0  | -10 |    |    |    |    |    |     |
| 03012800 |     | 20.4S | 171.6W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012806 |     | 21.0S | 170.2W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012812 |     | 21.5S | 169.0W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012818 |     | 21.8S | 168.2W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012900 |     | 22.1S | 167.4W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012906 |     | 22.5S | 166.6W  | 35   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012912 |     | 22.8S | 166.0W  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03012918 |     | 23.2S | 165.6W  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03013000 |     | 23.7S | 165.3W  | 30   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03013006 |     | 24.5S | 165.1W  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03013012 |     | 24.9S | 165.1W  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03013018 |     | 25.2S | 165.0W  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
| 03013100 |     | 25.6S | 164.8W  | 25   |    |    |     |     |    |    |    |     |    |     |    |    |    |    |    |     |
|          |     |       | AVERAGE |      | 3  | 91 | 141 | 171 |    |    |    |     | 0  | 5   | 0  | 5  |    |    |    |     |
|          |     |       | BIAS    |      |    |    |     |     |    |    |    |     | 0  | -5  | 0  | -5 |    |    |    |     |
|          |     |       | # CASES |      | 2  | 2  | 1   | 1   |    |    |    |     | 2  | 2   | 1  | 1  |    |    |    |     |

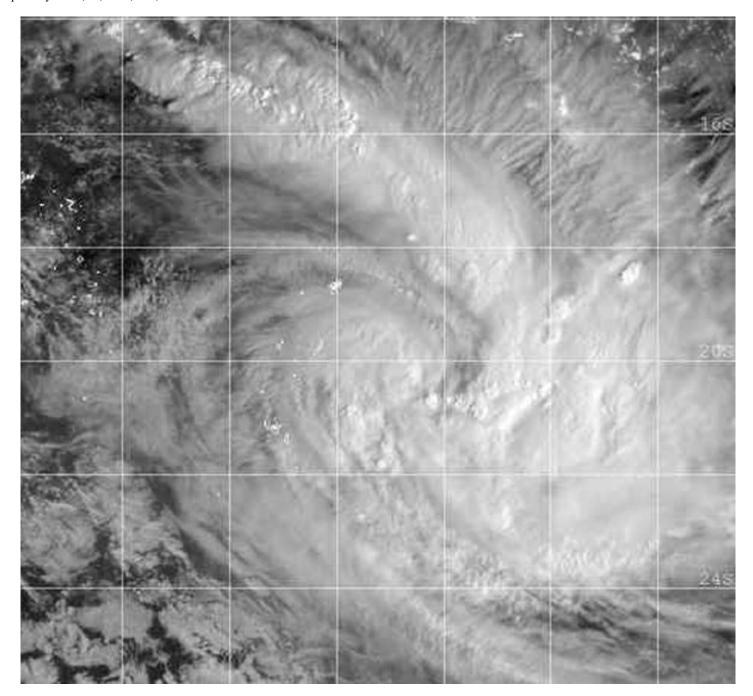
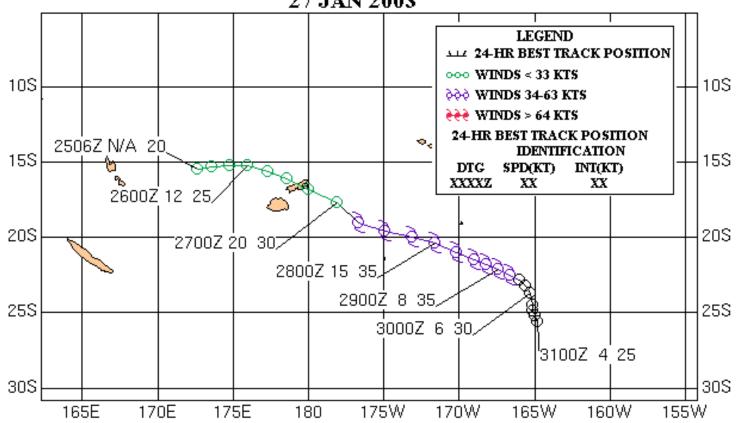
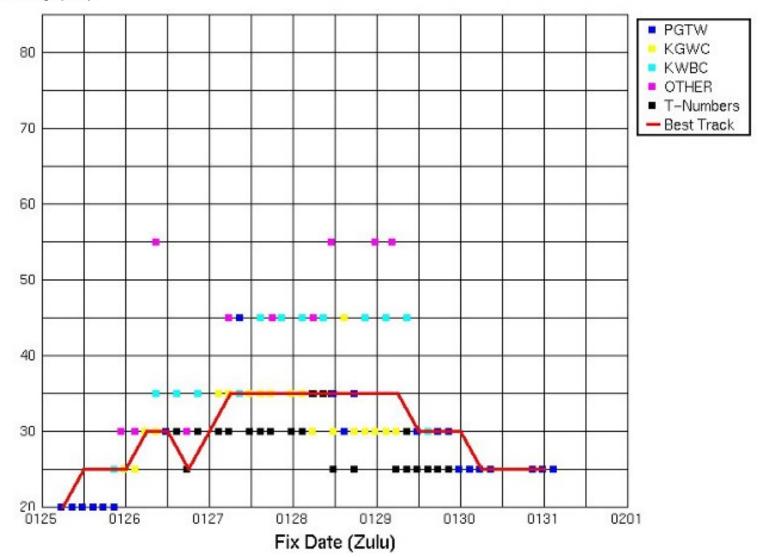


Figure 2-13P-1. 271833Z January 2003 GOES-10 visible imagery of TC 13P (Cilla), shows a good convective band wrapping in from the north, 441 nm east-southeast of Suva, with a peak intensity of 35 knots.

### TROPICAL CYCLONE 13P (CILLA) 27 JAN 2003



# Time Intensity for 13P



### Tropical Cyclone (TC) 13P (Cilla)\*



First Poor: 0600Z 25 Jan 03

First Fair: 1900Z 25 Jan 03

First TCFA: 1300Z 26 Jan 03

First Warning: 0600Z 27 Jan 03

Last Warning: 1800Z 27 Jan 03, Extratropical

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 2 + 1 Amended Warning

Remarks:

(1) Tropical Cyclone (TC) 13P developed in a broad monsoon trough on 25 January, 2003 approximately 380 nm west-northwest of Suva, Fiji and tracked eastward for one day and then southeastward over the next 5 days. The first warning was issued on the 27th of January at 0600Z with the final warning being issued as an amendment just 13 hours later. No operational impacts and no damage was reported.

|          |     |        | 5       | Statis | tics | fo  | r JT\ | NC c | n T | C1 | 3P |     |    |      |     |    |    |    |    |     |
|----------|-----|--------|---------|--------|------|-----|-------|------|-----|----|----|-----|----|------|-----|----|----|----|----|-----|
|          |     |        |         |        |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
|          | WRN | BEST 1 | TRACK   |        | PC   | SIT | ION   | ERRO | ORS | 3  |    |     | WI | ND E | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind   | 00   | 12  | 24    | 36   | 48  | 72 | 96 | 120 | 00 | 12   | 24  | 36 | 48 | 72 | 96 | 120 |
| 03012506 |     | 15.5S  | 172.6E  | 20     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012512 |     | 15.3S  | 173.6E  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012518 |     | 15.2S  | 174.8E  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012600 |     | 15.2S  | 176.0E  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012606 |     | 15.6S  | 177.3E  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012612 |     | 16.1S  | 178.6E  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012618 |     | 16.8S  | 180.0W  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012700 |     | 17.7S  | 178.1W  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012706 | 1   | 19.0S  | 176.7W  | 35     | 5    | 90  | 141   | 171  |     |    |    |     | 0  | 0    | 0   | -5 |    |    |    |     |
| 03012718 | 2   | 20.0S  | 173.1W  | 35     | 0    | 92  |       |      |     |    |    |     | 0  | -10  |     |    |    |    |    |     |
| 03012800 |     | 20.4S  | 171.6W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012806 |     | 21.0S  | 170.2W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012812 |     | 21.5S  | 169.0W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012818 |     | 21.8S  | 168.2W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012900 |     | 22.1S  | 167.4W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012906 |     | 22.5S  | 166.6W  | 35     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012912 |     | 22.8S  | 166.0W  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03012918 |     | 23.2S  | 165.6W  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03013000 |     | 23.7S  | 165.3W  | 30     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03013006 |     | 24.5S  | 165.1W  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03013012 |     | 24.9S  | 165.1W  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03013018 |     | 25.2S  | 165.0W  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
| 03013100 |     | 25.6S  | 164.8W  | 25     |      |     |       |      |     |    |    |     |    |      |     |    |    |    |    |     |
|          |     |        | AVERAGE |        | 3    | 91  | 141   | 171  |     |    |    |     | 0  | 5    | 0   | 5  |    |    |    |     |
|          |     |        | BIAS    |        |      |     |       |      |     |    |    |     | 0  | -5   | 0   | -5 |    |    |    |     |
|          |     |        | # CASES |        | 2    | 2   | 1     | 1    |     |    |    |     | 2  | 2    | 1   | 1  |    |    |    |     |

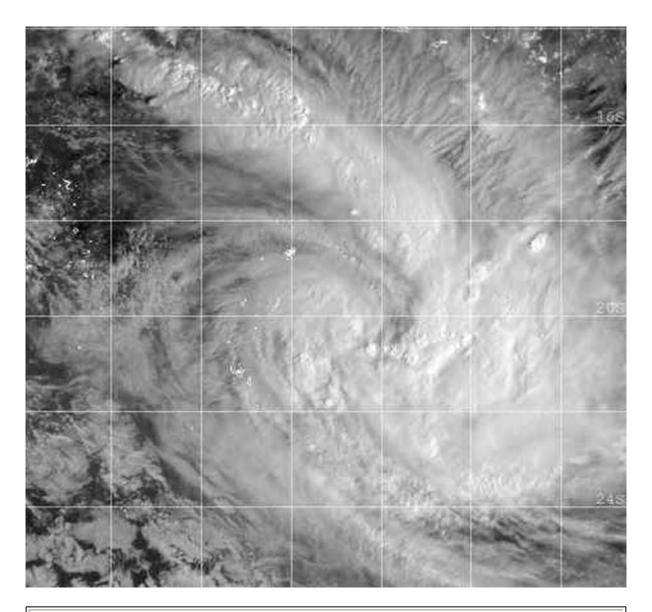
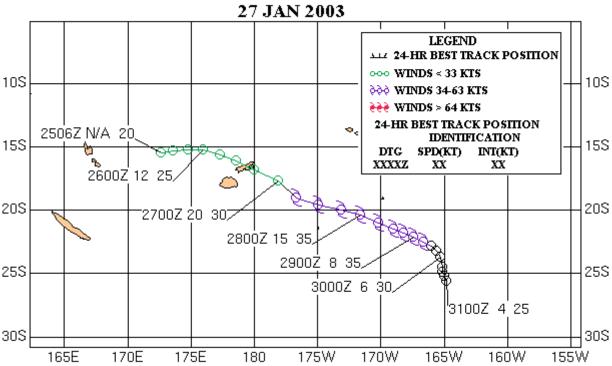


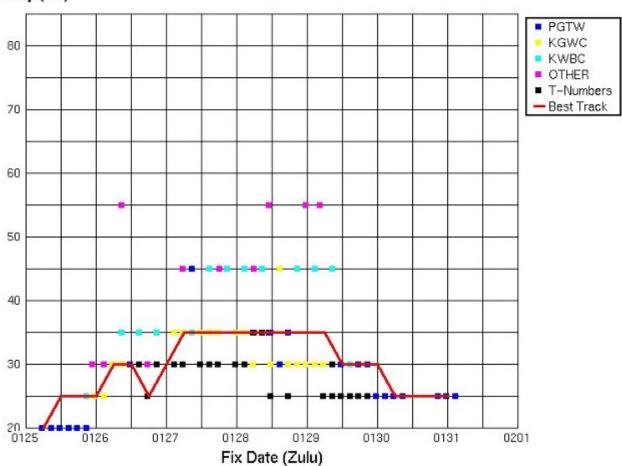
Figure 2-13P-1. 271833Z January 2003 GOES-10 visible imagery of TC 13P (Cilla), shows a good convective band wrapping in from the north, 441 nm east-southeast of Suva, with a peak intensity of 35 knots.

## TROPICAL CYCLONE 13P (CILLA)



# Time Intensity for 13P





## **Tropical Cyclone (TC) 14S (Fiona)\***



First Poor: 1000Z 03 Feb 03

First Fair: 2030Z 04 Feb 03

First TCFA: 0500Z 05 Feb 03

First Warning: 1200Z 05 Feb 03

Last Warning: 0000Z 13 Feb 03, Dissipated

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 19

Remarks:

- (1) Tropical Cyclone (TC) 14S developed approximately 180 nm south of Java around 3 February 2003. The cyclone initially tracked slowly west to west-southwestward (4-6 knots) while intensifying at the climatological rate of one Dvorak T-number per day. While tracking west-southwestward, TC 14S attained a maximum intensity of 110 knots briefly at approximately 0600Z on 09 February and then quickly weakened back to 100 knots, which was maintained for a further 24 hours. Subsequently, the cyclone began to weaken and move poleward. Increasing vertical wind shear caused decoupling of the deep convection from the low level circulation pattern. The final warning was issued on 13 February as the cyclone dissipated over open water.
- (2) No operational impacts damage was reported.

| 04 41   |          |       |      | 0440  |
|---------|----------|-------|------|-------|
| Statist | tice tor | TIWC: | on I | 1.14S |

|          | WRN | BEST  | TRACK   |      | РО | SIT | ION | ERR | ORS |     |    |     | WI | ND I | ERR | ORS | 3   |     |    |     |
|----------|-----|-------|---------|------|----|-----|-----|-----|-----|-----|----|-----|----|------|-----|-----|-----|-----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 03020306 |     | 11.7S | 115.3E  | 25   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020312 |     | 11.7S | 114.9E  | 25   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020318 |     | 11.7S | 114.5E  | 25   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020400 |     | 11.7S | 114.1E  | 20   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020406 |     | 11.7S | 113.7E  | 20   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020412 |     | 11.7S | 113.3E  | 20   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020418 |     | 11.7S | 112.9E  | 20   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020500 |     | 11.7S | 112.5E  | 20   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020506 |     | 11.7S | 112.1E  | 30   |    |     |     |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03020512 | 1   | 11.8S | 111.5E  | 35   | 41 | 59  | 71  | 78  | 41  | 33  |    |     | 0  | 0    | 0   | 5   | -5  | -25 |    |     |
| 03020518 | 2   | 11.9S | 110.8E  | 35   | 6  | 19  | 32  | 13  | 19  | 30  |    |     | 0  | -5   | 0   | -5  | -15 | -30 |    |     |
| 03020600 | 3   | 12.0S | 110.1E  | 45   | 13 | 24  | 34  | 0   | 8   | 35  |    |     | 0  | 0    | 0   | -10 | -20 | -25 |    |     |
| 03020606 | 4   | 12.0S | 109.4E  | 50   | 0  | 6   | 17  | 29  | 32  | 76  |    |     | 0  | 0    | -5  | -15 | -20 | -35 |    |     |
| 03020612 | 5   | 12.0S | 108.7E  | 55   | 11 | 13  | 35  | 30  | 41  | 105 |    |     | 0  | 0    | -10 | -20 | -25 | -25 |    |     |
| 03020618 | 6   | 12.0S | 108.0E  | 55   | 11 | 24  | 43  | 42  | 51  | 139 |    |     | 0  | -5   | -15 | -20 | -25 | -15 |    |     |
| 03020700 | 7   | 12.0S | 107.2E  | 60   | 18 | 43  | 56  | 64  | 81  |     |    |     | 0  | -10  | -20 | -25 | -20 |     |    |     |
| 03020712 | 8   | 12.6S | 105.2E  | 75   | 11 | 17  | 13  | 0   | 13  |     |    |     | 0  | -10  | -15 | -10 | -5  |     |    |     |
| 03020800 | 9   | 13.4S | 103.6E  | 90   | 0  | 8   | 13  | 24  | 42  |     |    |     | 0  | 0    | 10  | 5   | -5  |     |    |     |
| 03020812 | 10  | 14.4S | 101.8E  | 100  | 13 | 6   | 18  | 53  | 96  |     |    |     | 0  | 5    | 5   | -5  | -10 |     |    |     |
| 03020900 | 11  | 15.4S | 99.9E   | 100  | 5  | 21  | 42  | 72  | 67  |     |    |     | 0  | 0    | -10 | -10 | -10 |     |    |     |
| 03020912 | 12  | 16.4S | 97.7E   | 100  | 11 | 31  | 85  | 124 | 152 |     |    |     | 0  | -10  | -10 | 0   | 5   |     |    |     |
| 03021000 | 13  | 16.7S | 95.3E   | 100  | 5  | 60  | 122 | 180 | 254 |     |    |     | 0  | 0    | 0   | 0   | 10  |     |    |     |
| 03021012 | 14  | 16.8S | 93.4E   | 90   | 5  | 42  | 70  | 112 | 193 |     |    |     | 0  | 0    | 5   | 10  | 5   |     |    |     |
| 03021100 | 15  | 17.6S | 91.9E   | 80   | 16 | 25  | 62  | 82  | 93  |     |    |     | 0  | -5   | 0   | 0   | 20  |     |    |     |
| 03021112 | 16  | 18.6S | 91.1E   | 75   | 6  | 26  | 64  | 99  |     |     |    |     | 5  | 10   | 5   | 20  |     |     |    |     |
| 03021200 | 17  | 20.0S | 91.0E   | 60   | 0  | 25  | 42  |     |     |     |    |     | 0  | 0    | 15  |     |     |     |    |     |
| 03021212 | 18  | 21.4S | 91.8E   | 55   | 0  | 21  |     |     |     |     |    |     | 0  | 15   |     |     |     |     |    |     |
| 03021300 | 19  | 22.2S | 92.4E   | 30   | 13 |     |     |     |     |     |    |     | 0  |      |     |     |     |     |    |     |
|          |     |       | AVERAGE |      | 10 | 26  | 48  | 63  | 79  | 70  |    |     | 0  | 4    | 7   | 10  | 13  | 26  |    |     |
|          |     |       | BIAS    |      |    |     |     |     |     |     |    |     | 0  | -1   | -3  | -5  | -8  | -26 |    |     |
|          |     |       | # CASES |      | 19 | 18  | 17  | 16  | 15  | 6   |    |     | 19 | 18   | 17  | 16  | 15  | 6   |    |     |

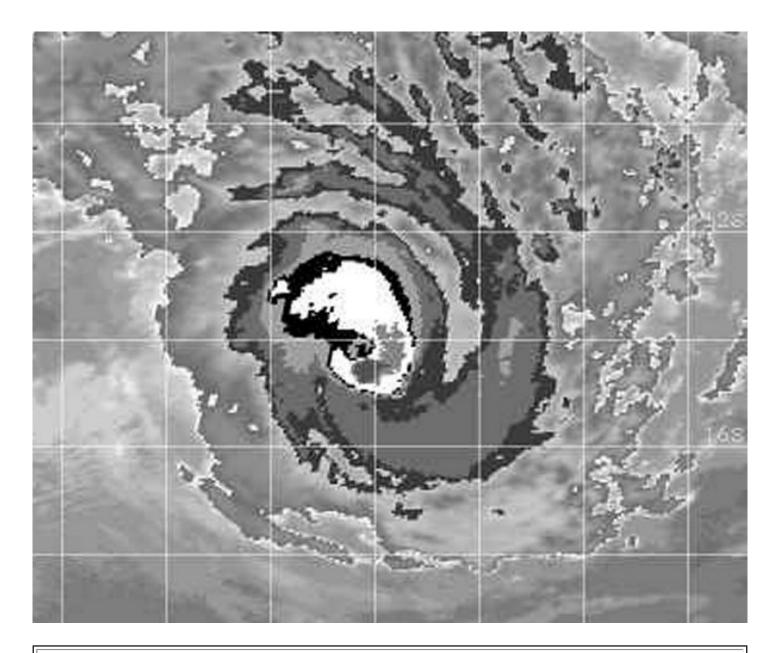


Figure 2-14S-1. 081024Z February 2003 GMS-5 enhanced infrared imagery of TC 14S (Fiona), 325 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

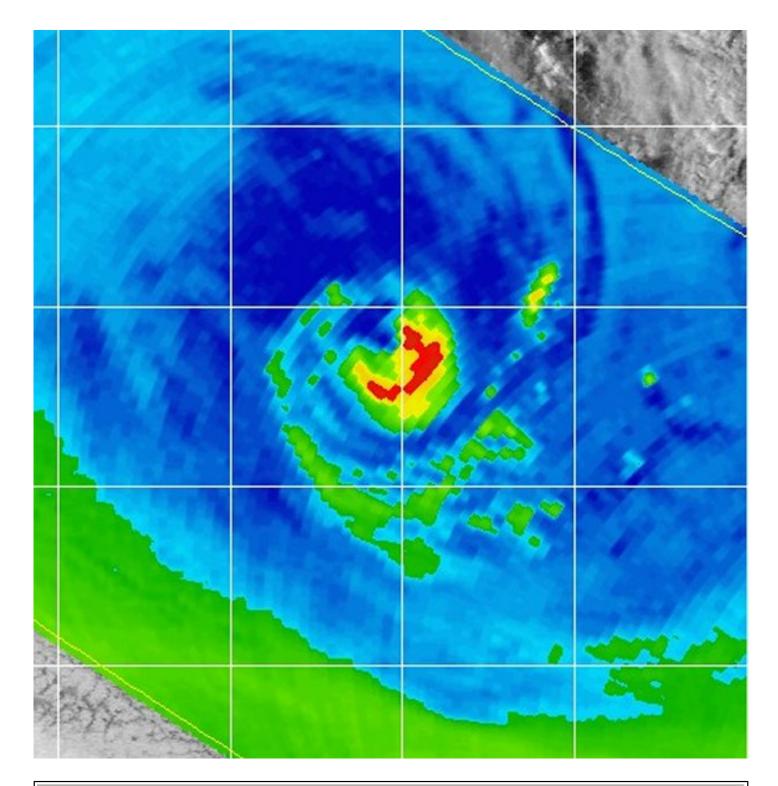
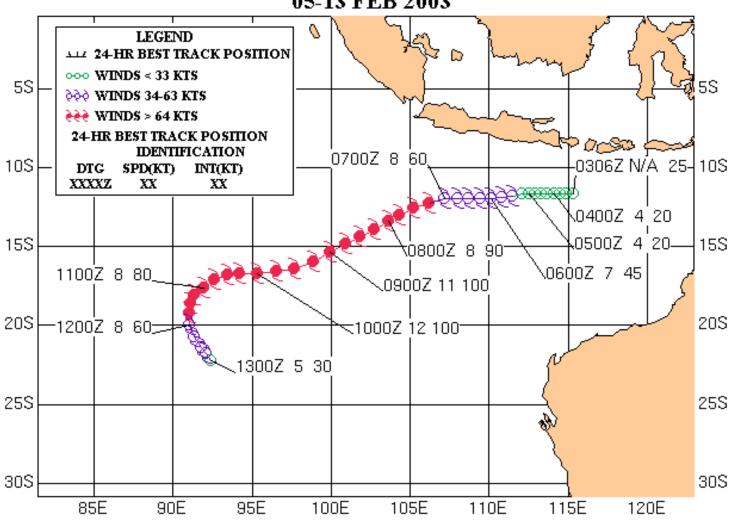
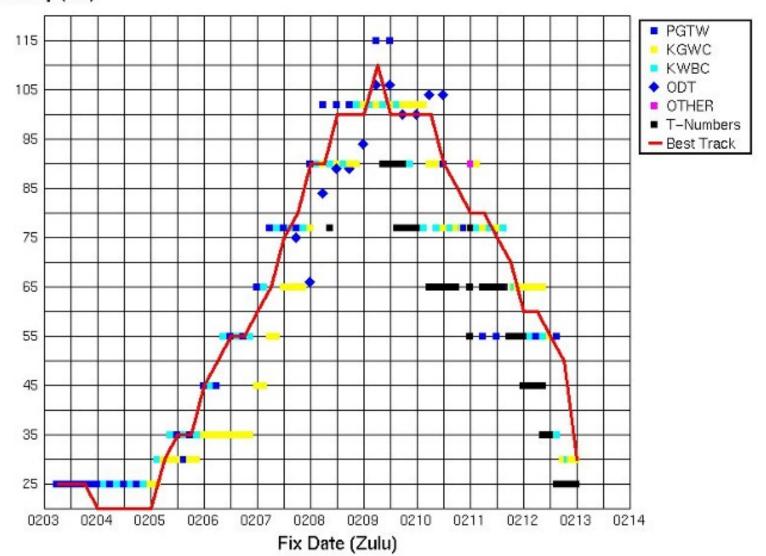


Figure 2-14S-2. 091124Z February 2003 85 GHz TRMM imagery of TC 14S (Fiona), 295 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

### TROPICAL CYCLONE 14S (FIONA) 05-13 FEB 2003



# Time Intensity for 14S



### **Tropical Cyclone (TC) 14S (Fiona)\***



First Poor: 1000Z 03 Feb 03

First Fair: 2030Z 04 Feb 03

First TCFA: 0500Z 05 Feb 03

First Warning: 1200Z 05 Feb 03

Last Warning: 0000Z 13 Feb 03, Dissipated

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 19

Remarks:

- (1) Tropical Cyclone (TC) 14S developed approximately 180 nm south of Java around 3 February 2003. The cyclone initially tracked slowly west to west-southwestward (4-6 knots) while intensifying at the climatological rate of one Dvorak T-number per day. While tracking west-southwestward, TC 14S attained a maximum intensity of 110 knots briefly at approximately 0600Z on 09 February and then quickly weakened back to 100 knots, which was maintained for a further 24 hours. Subsequently, the cyclone began to weaken and move poleward. Increasing vertical wind shear caused decoupling of the deep convection from the low level circulation pattern. The final warning was issued on 13 February as the cyclone dissipated over open water.
- (2) No operational impacts damage was reported.

|          |     |       |         | Stat | isti | cs | for J | ITW | C on | TC  | 14S | ;   |    |     |     |     |     |     |    |     |
|----------|-----|-------|---------|------|------|----|-------|-----|------|-----|-----|-----|----|-----|-----|-----|-----|-----|----|-----|
|          |     |       |         |      |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
|          |     |       |         |      |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
|          |     |       | TRACK   |      |      |    |       | ERR |      |     |     |     |    |     | ERR |     | 5   |     |    |     |
| DTG      | NO. | LAT   | LONG    | wind | 00   | 12 | 24    | 36  | 48   | 72  | 96  | 120 | 00 | 12  | 24  | 36  | 48  | 72  | 96 | 120 |
| 03020306 |     | 11.7S | 115.3E  | 25   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020312 |     | 11.7S | 114.9E  | 25   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020318 |     | 11.7S | 114.5E  | 25   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020400 |     | 11.7S | 114.1E  | 20   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020406 |     | 11.7S | 113.7E  | 20   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020412 |     | 11.7S | 113.3E  | 20   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020418 |     | 11.7S | 112.9E  | 20   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020500 |     | 11.7S | 112.5E  | 20   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020506 |     | 11.7S | 112.1E  | 30   |      |    |       |     |      |     |     |     |    |     |     |     |     |     |    |     |
| 03020512 | 1   | 11.8S | 111.5E  | 35   | 41   | 59 | 71    | 78  | 41   | 33  |     |     | 0  | 0   | 0   | 5   | -5  | -25 |    |     |
| 03020518 | 2   | 11.9S | 110.8E  | 35   | 6    | 19 | 32    | 13  | 19   | 30  |     |     | 0  | -5  | 0   | -5  | -15 | -30 |    |     |
| 03020600 | 3   | 12.0S | 110.1E  | 45   | 13   | 24 | 34    | 0   | 8    | 35  |     |     | 0  | 0   | 0   | -10 | -20 | -25 |    |     |
| 03020606 | 4   | 12.0S | 109.4E  | 50   | 0    | 6  | 17    | 29  | 32   | 76  |     |     | 0  | 0   | -5  | -15 | -20 | -35 |    |     |
| 03020612 | 5   | 12.0S | 108.7E  | 55   | 11   | 13 | 35    | 30  | 41   | 105 |     |     | 0  | 0   | -10 | -20 | -25 | -25 |    |     |
| 03020618 | 6   | 12.0S | 108.0E  | 55   | 11   | 24 | 43    | 42  | 51   | 139 |     |     | 0  | -5  | -15 | -20 | -25 | -15 |    |     |
| 03020700 | 7   | 12.0S | 107.2E  | 60   | 18   | 43 | 56    | 64  | 81   |     |     |     | 0  | -10 | -20 | -25 | -20 |     |    |     |
| 03020712 | 8   | 12.6S | 105.2E  | 75   | 11   | 17 | 13    | 0   | 13   |     |     |     | 0  | -10 | -15 | -10 | -5  |     |    |     |
| 03020800 | 9   | 13.4S | 103.6E  | 90   | 0    | 8  | 13    | 24  | 42   |     |     |     | 0  | 0   | 10  | 5   | -5  |     |    |     |
| 03020812 | 10  | 14.4S | 101.8E  | 100  | 13   | 6  | 18    | 53  | 96   |     |     |     | 0  | 5   | 5   | -5  | -10 |     |    |     |
| 03020900 | 11  | 15.4S | 99.9E   | 100  | 5    | 21 | 42    | 72  | 67   |     |     |     | 0  | 0   | -10 | -10 | -10 |     |    |     |
| 03020912 | 12  | 16.4S | 97.7E   | 100  | 11   | 31 | 85    | 124 | 152  |     |     |     | 0  | -10 | -10 | 0   | 5   |     |    |     |
| 03021000 | 13  | 16.7S | 95.3E   | 100  | 5    | 60 | 122   | 180 | 254  |     |     |     | 0  | 0   | 0   | 0   | 10  |     |    |     |
| 03021012 | 14  | 16.8S | 93.4E   | 90   | 5    | 42 | 70    | 112 | 193  |     |     |     | 0  | 0   | 5   | 10  | 5   |     |    |     |
| 03021100 | 15  | 17.6S | 91.9E   | 80   | 16   | 25 | 62    | 82  | 93   |     |     |     | 0  | -5  | 0   | 0   | 20  |     |    |     |
| 03021112 | 16  | 18.6S | 91.1E   | 75   | 6    | 26 | 64    | 99  |      |     |     |     | 5  | 10  | 5   | 20  |     |     |    |     |
| 03021200 | 17  | 20.0S | 91.0E   | 60   | 0    | 25 | 42    |     |      |     |     |     | 0  | 0   | 15  |     |     |     |    |     |
| 03021212 | 18  | 21.4S | 91.8E   | 55   | 0    | 21 |       |     |      |     |     |     | 0  | 15  |     |     |     |     |    |     |
| 03021300 | 19  | 22.2S | 92.4E   | 30   | 13   |    |       |     |      |     |     |     | 0  |     |     |     |     |     |    |     |
|          |     |       | AVERAGE |      | 10   | 26 | 48    | 63  | 79   | 70  |     |     | 0  | 4   | 7   | 10  | 13  | 26  |    |     |
|          |     |       | BIAS    |      |      |    |       |     |      |     |     |     | 0  | -1  | -3  | -5  | -8  | -26 |    |     |
|          |     |       | # CASES |      | 19   | 18 | 17    | 16  | 15   | 6   |     |     | 19 | 18  | 17  | 16  | 15  | 6   |    |     |

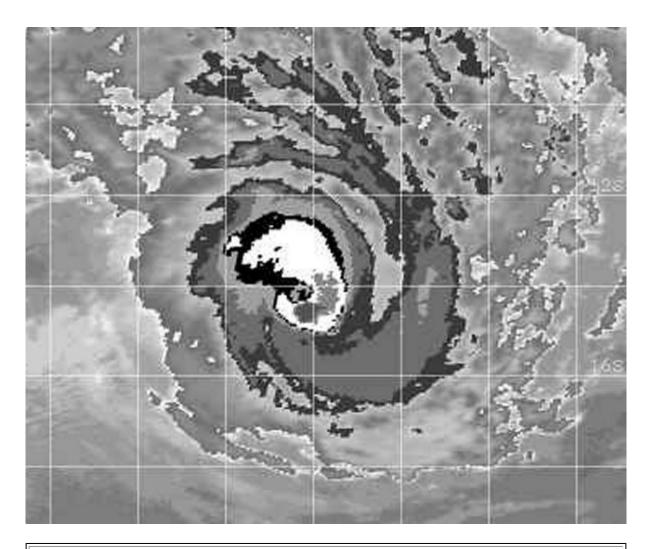


Figure 2-14S-1. 081024Z February 2003 GMS-5 enhanced infrared imagery of TC 14S (Fiona), 325 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

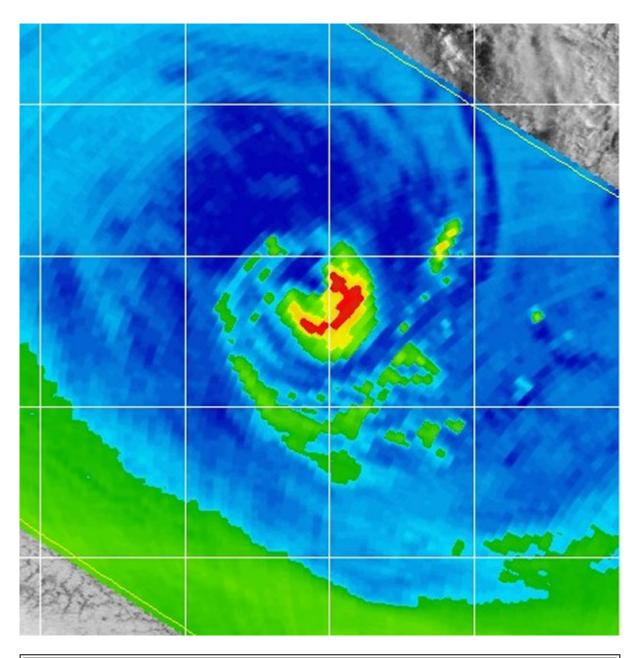
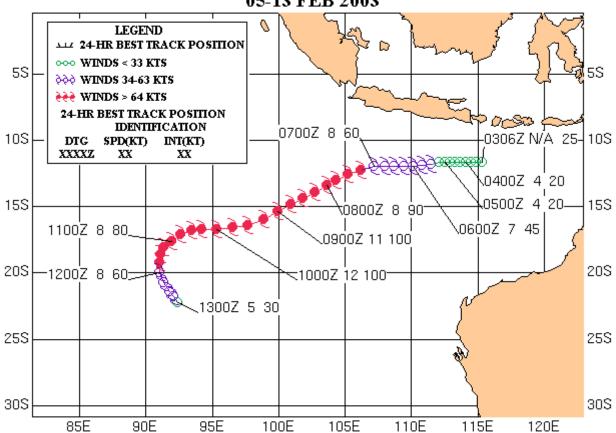
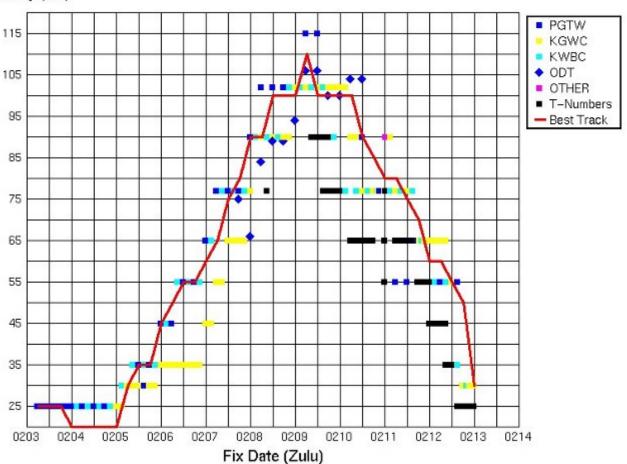


Figure 2-14S-2. 091124Z February 2003 85 GHz TRMM imagery of TC 14S (Fiona), 295 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

#### TROPICAL CYCLONE 14S (FIONA) 05-13 FEB 2003



## Time Intensity for 14S



# **Tropical Cyclone (TC) 15P (Dovi)\***



First Poor: 2200Z 04 Feb 03

First Fair: 0230Z 05 Feb 03

First TCFA: 0700Z 05 Feb 03

First Warning: 1800Z 05 Feb 03

Last Warning: 1800Z 10 Feb 03, Extratropical

Max Intensity: 130 kts, gusts to 155 kts

Landfall: None

Total Warnings: 11

Remarks: None

|          |     |        |        | Statis | tics | s fo | r Jī | ΓW | C on | TC | 15 | P   |     |      |     |     |     |    |    |     |
|----------|-----|--------|--------|--------|------|------|------|----|------|----|----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |        |        |        |      |      |      |    |      |    |    |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST 1 | TRACK  |        | РО   | SIT  | ION  | ER | ROR  | S  |    |     | WII | ND E | RR  | ORS |     |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00   | 12   | 24   | 36 | 48   | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020418 |     | 10.2S  | 162.9W | 20     |      |      |      |    |      |    |    |     |     |      |     |     |     |    |    |     |
| 03020500 |     | 10.7S  | 162.9W | 20     |      |      |      |    |      |    |    |     |     |      |     |     |     |    |    |     |
| 03020506 |     | 11.3S  | 163.0W | 25     |      |      |      |    |      |    |    |     |     |      |     |     |     |    |    |     |
| 03020512 |     | 12.0S  | 163.0W | 30     |      |      |      |    |      |    |    |     |     |      |     |     |     |    |    |     |
| 03020518 | 1   | 12.8S  | 162.9W | 30     | 11   | 31   | 71   | 92 | 108  |    |    |     | 0   | -5   | -25 | -35 | -60 |    |    |     |

|          |    |       |         |     |    |    |    |    |    | <br> | <br> |     |     |     |     | <br> |  |
|----------|----|-------|---------|-----|----|----|----|----|----|------|------|-----|-----|-----|-----|------|--|
| 03020606 | 2  | 14.4S | 162.6W  | 40  | 5  | 35 | 35 | 35 | 29 |      | -5   | -20 | -30 | -60 | -75 |      |  |
| 03020618 | 3  | 15.8S | 163.3W  | 65  | 5  | 18 | 21 | 38 | 42 |      | 0    | 10  | -15 | -20 | -10 |      |  |
| 03020706 | 4  | 16.7S | 164.4W  | 80  | 13 | 24 | 44 | 37 | 52 |      | -5   | -30 | -35 | -25 | -10 |      |  |
| 03020718 | 5  | 17.5S | 165.5W  | 115 | 20 | 26 | 56 | 61 | 64 |      | 10   | 5   | 10  | 0   | 10  |      |  |
| 03020806 | 6  | 18.3S | 166.6W  | 130 | 13 | 26 | 45 | 61 | 72 |      | 0    | 0   | -5  | 5   | 10  |      |  |
| 03020818 | 7  | 19.4S | 168.0W  | 130 | 12 | 22 | 41 | 50 | 87 |      | 0    | -5  | 5   | 10  | 45  |      |  |
| 03020906 | 8  | 20.8S | 168.9W  | 125 | 0  | 25 | 37 | 20 |    |      | 0    | 10  | 15  | 35  |     |      |  |
| 03020918 | 9  | 22.4S | 169.2W  | 105 | 11 | 37 | 53 |    |    |      | 5    | 10  | 40  |     |     |      |  |
| 03021006 | 10 | 24.0S | 168.8W  | 90  | 17 | 42 |    |    |    |      | -5   | 25  |     |     |     |      |  |
| 03021018 | 11 | 25.4S | 168.7W  | 50  | 38 |    |    |    |    |      | 5    |     |     |     |     |      |  |
| 03021100 |    | 26.2S | 169.0W  | 50  |    |    |    |    |    |      |      |     |     |     |     |      |  |
|          |    |       | AVERAGE |     | 14 | 29 | 45 | 49 | 65 |      | 3    | 12  | 20  | 24  | 31  |      |  |
|          |    |       | BIAS    |     |    |    |    |    |    |      | 0    | 0   | -4  | -11 | -13 |      |  |
|          |    |       | # CASES |     | 11 | 10 | 9  | 8  | 7  |      | 11   | 10  | 9   | 8   | 7   |      |  |

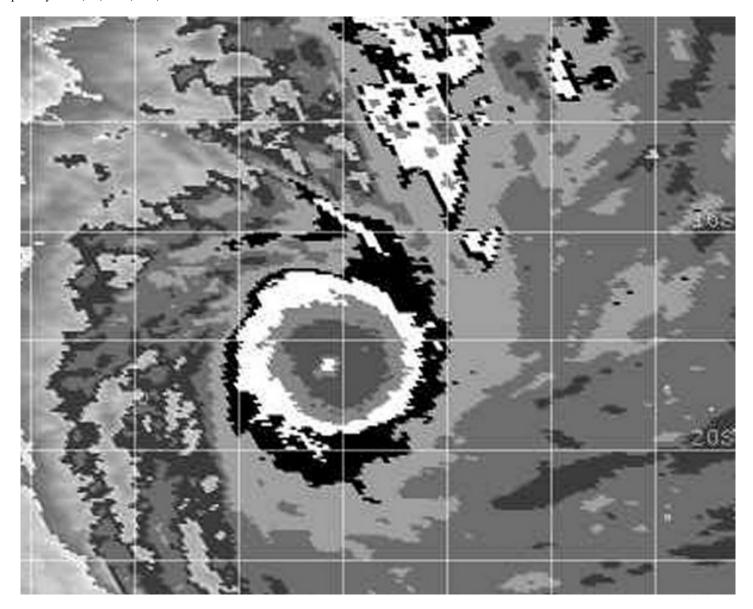


Figure 2-15P-1. 080424Z February 2003 GMS-5 enhanced infrared imagery of TC 15P (Dovi), 388 nm southeast of Pago Pago island, with a peak intensity of 130 knots.

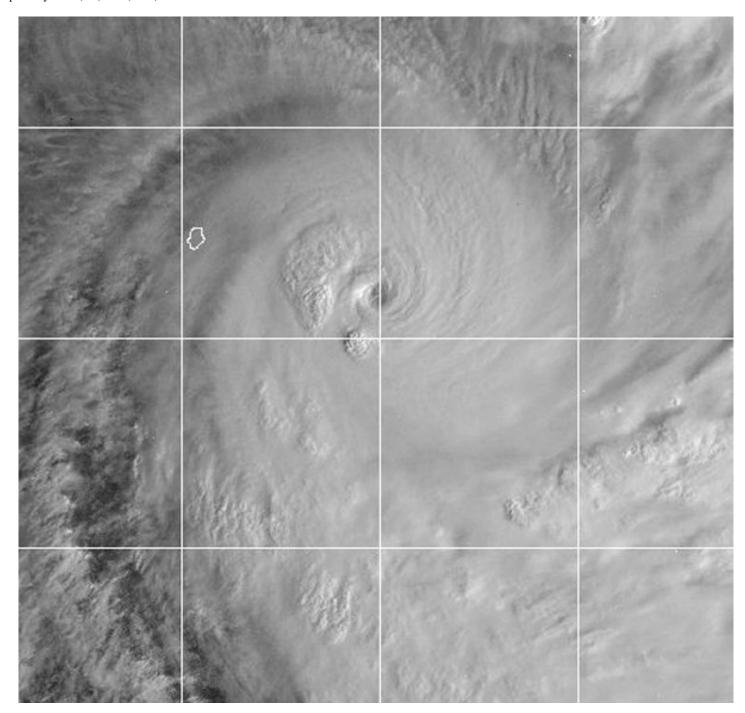
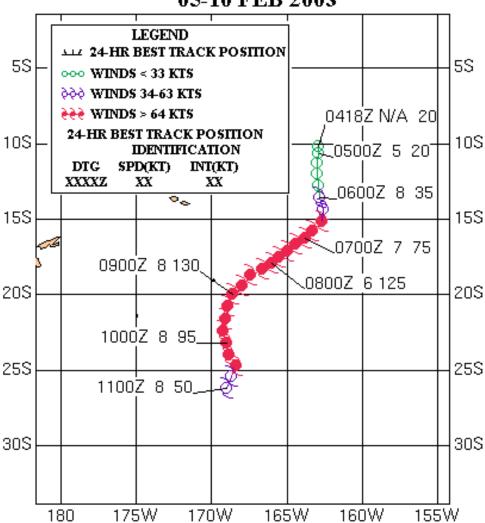
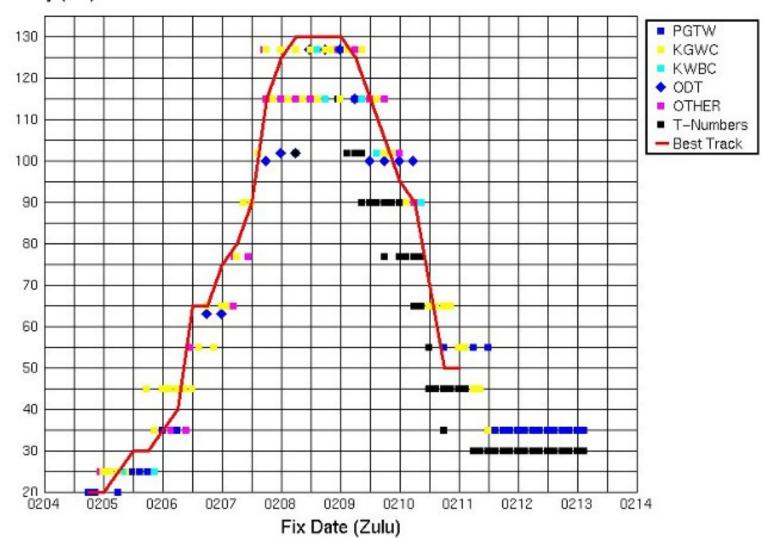


Figure 2-15P-2. 081800Z February 2003 GOES-10 visible imagery of TC 15P (Dovi), 325 nm southeast of Pago Pago island, with a peak intensity of 130 knots.

### TROPICAL CYCLONE 15P (DOVI) 05-10 FEB 2003



## Time Intensity for 15P



## **Tropical Cyclone (TC) 15P (Dovi)\***

First Poor : 2200Z 04 Feb 03

First Fair: 0230Z 05 Feb 03

First TCFA: 0700Z 05 Feb 03

First Warning: 1800Z 05 Feb 03

Last Warning: 1800Z 10 Feb 03, Extratropical

Max Intensity: 130 kts, gusts to 155 kts

Landfall : None

Total Warnings: 11

Remarks: None

|          |     |        | 5       | Statis | tics | s fo | r J | ΓW   | C on | TC | :15 | P   |    |      |     |     |     |    |    |     |
|----------|-----|--------|---------|--------|------|------|-----|------|------|----|-----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |        |         |        |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST 1 | ΓRACK   |        | РО   | SIT  | ION | I ER | ROR  | RS |     |     | WI | ND E | ERR | ORS |     |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind   | 00   | 12   | 24  | 36   | 48   | 72 | 96  | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020418 |     | 10.2S  | 162.9W  | 20     |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
| 03020500 |     | 10.7S  | 162.9W  | 20     |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
| 03020506 |     | 11.3S  | 163.0W  | 25     |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
| 03020512 |     | 12.0S  | 163.0W  | 30     |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
| 03020518 | 1   | 12.8S  | 162.9W  | 30     | 11   | 31   | 71  | 92   | 108  |    |     |     | 0  | -5   | -25 | -35 | -60 |    |    |     |
| 03020606 | 2   | 14.4S  | 162.6W  | 40     | 5    | 35   | 35  | 35   | 29   |    |     |     | -5 | -20  | -30 | -60 | -75 |    |    |     |
| 03020618 | 3   | 15.8S  | 163.3W  | 65     | 5    | 18   | 21  | 38   | 42   |    |     |     | 0  | 10   | -15 | -20 | -10 |    |    |     |
| 03020706 | 4   | 16.7S  | 164.4W  | 80     | 13   | 24   | 44  | 37   | 52   |    |     |     | -5 | -30  | -35 | -25 | -10 |    |    |     |
| 03020718 | 5   | 17.5S  | 165.5W  | 115    | 20   | 26   | 56  | 61   | 64   |    |     |     | 10 | 5    | 10  | 0   | 10  |    |    |     |
| 03020806 | 6   | 18.3S  | 166.6W  | 130    | 13   | 26   | 45  | 61   | 72   |    |     |     | 0  | 0    | -5  | 5   | 10  |    |    |     |
| 03020818 | 7   | 19.4S  | 168.0W  | 130    | 12   | 22   | 41  | 50   | 87   |    |     |     | 0  | -5   | 5   | 10  | 45  |    |    |     |
| 03020906 | 8   | 20.8S  | 168.9W  | 125    | 0    | 25   | 37  | 20   |      |    |     |     | 0  | 10   | 15  | 35  |     |    |    |     |
| 03020918 | 9   | 22.4S  | 169.2W  | 105    | 11   | 37   | 53  |      |      |    |     |     | 5  | 10   | 40  |     |     |    |    |     |
| 03021006 | 10  | 24.0S  | 168.8W  | 90     | 17   | 42   |     |      |      |    |     |     | -5 | 25   |     |     |     |    |    |     |
| 03021018 | 11  | 25.4S  | 168.7W  | 50     | 38   |      |     |      |      |    |     |     | 5  |      |     |     |     |    |    |     |
| 03021100 |     | 26.2S  | 169.0W  | 50     |      |      |     |      |      |    |     |     |    |      |     |     |     |    |    |     |
|          |     |        | AVERAGE |        | 14   | 29   | 45  | 49   | 65   |    |     |     | 3  | 12   | 20  | 24  | 31  |    |    |     |
|          |     |        | BIAS    |        |      |      |     |      |      |    |     |     | 0  | 0    | -4  | -11 | -13 |    |    |     |
|          |     |        | # CASES |        | 11   | 10   | 9   | 8    | 7    |    |     |     | 11 | 10   | 9   | 8   | 7   |    |    |     |

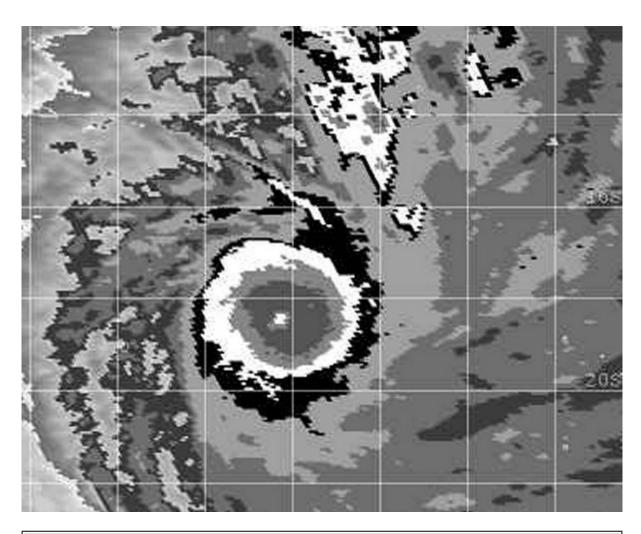


Figure 2-15P-1. 080424Z February 2003 GMS-5 enhanced infrared imagery of TC 15P (Dovi), 388 nm southeast of Pago Pago island, with a peak intensity of 130 knots.

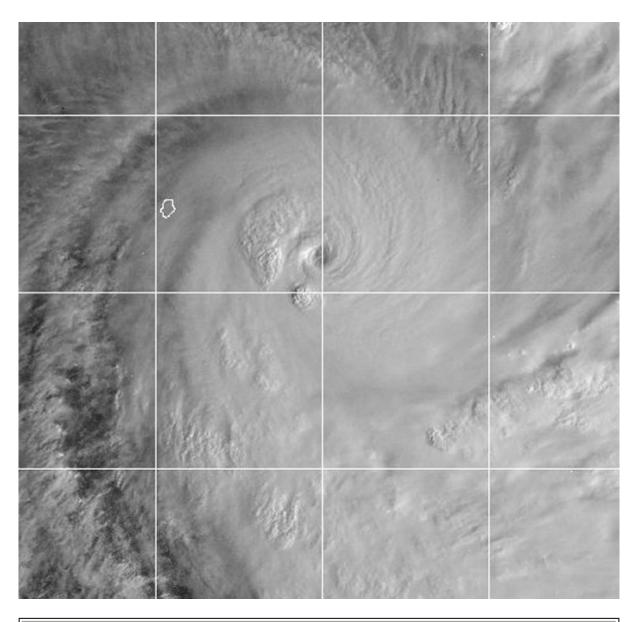
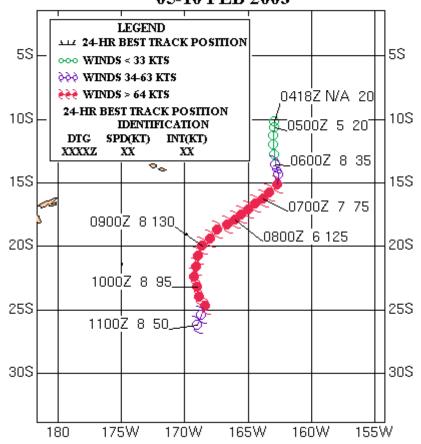
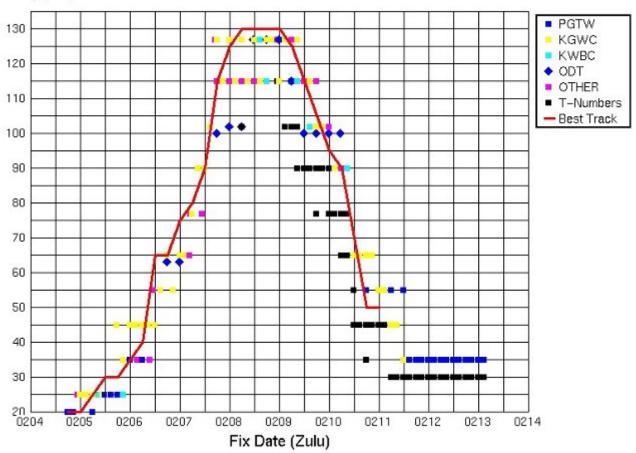


Figure 2-15P-2. 081800Z February 2003 GOES-10 visible imagery of TC 15P (Dovi), 325 nm southeast of Pago Pago island, with a peak intensity of 130 knots.

#### TROPICAL CYCLONE 15P (DOVI) 05-10 FEB 2003



## Time Intensity for 15P



## Tropical Cyclone (TC) 16S (Gerry)\*



First Poor: N/A

First Fair: 1800Z 07 Feb 03

First TCFA: 0630Z 08 Feb 03

First Warning: 1800Z 08 Feb 03

Last Warning: 1200Z 15 Feb 03, Dissipation

Max Intensity: 105 kts, gusts to 130 kts

Landfall: None

Total Warnings: 15

Remarks:

(1) Tropical Cyclone (TC) 16S developed approximately 430 Nm north-northwest of Mauritius within a well established monsoon trough consisting of 3 separate circulations that spanned across the South Indian Ocean. The other 2 circulations eventually became TCs 17S and 18S. Initially, TC 16S was caught in the weak equatorial steering flow of a low to mid level ridge to the southwest. TC 16S remained a weak system at the surface during this time, but maintained a well developed mid-level circulation. As the cyclone intensified, it made a quick turn south and curved towards the southeast as the steering ridge moved to the east of the system. TC 16S eventually went extratropical and JTWC issued the final warning on 15 February.

TC 16S reached a maximum intensity of 105 knots on 13 February when the upper level conditions improved and enhanced outflow into a mid-latitude trough. TC 16S passed within approximately 60 Nm northeast of Mauritius at its maximum intensity and weakened thereafter as it encountered increasing vertical wind shear.

TCs 16S, 17S, and 18S are an interesting case on how multiple TCs in one tropical basin behave and interact with each other in the open water. All systems developed at approximately the same latitude, yet displayed few signs of direct interaction through their life cycle.

(2) Reports indicated minimal damage on Mauritius with this system.

|          |     |        |         | Stat | isti | cs fo | or J1 | ΓWC | on ' | TC | 16S | ;   |     |      |     |     |     |    |    |     |
|----------|-----|--------|---------|------|------|-------|-------|-----|------|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |        |         |      |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST T | TRACK   |      | PO   | SITIO | ON E  | RRC | RS   |    |     |     | WIN | ID E | RRC | DRS |     |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind | 00   | 12    | 24    | 36  | 48   | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020718 |     | 14.98  | 55.9E   | 25   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020800 |     | 14.5S  | 56.1E   | 25   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020806 |     | 14.1S  | 56.2E   | 25   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020812 |     | 13.7S  | 56.3E   | 30   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020818 | 1   | 13.5S  | 56.1E   | 30   | 60   | 103   | 158   | 223 | 253  |    |     |     | 0   | 0    | 10  | 5   | 0   |    |    |     |
| 03020906 | 2   | 13.0S  | 55.5E   | 35   | 0    | 32    | 105   | 116 | 127  |    |     |     | 0   | 10   | 10  | 10  | 15  |    |    |     |
| 03020918 | 3   | 12.1S  | 54.9E   | 35   | 8    | 53    | 101   | 123 | 147  |    |     |     | 0   | 0    | -5  | 0   | 15  |    |    |     |
| 03021006 | 4   | 11.4S  | 54.4E   | 45   | 13   | 60    | 118   | 168 | 189  |    |     |     | 0   | -5   | 0   | 15  | 30  |    |    |     |
| 03021018 | 5   | 12.1S  | 53.9E   | 55   | 50   | 113   | 193   | 200 | 171  |    |     |     | 0   | 5    | 20  | 25  | 15  |    |    |     |
| 03021106 | 6   | 13.3S  | 53.7E   | 60   | 0    | 44    | 38    | 19  | 57   |    |     |     | 0   | 15   | 20  | 0   | -25 |    |    |     |
| 03021118 | 7   | 15.5S  | 53.8E   | 60   | 21   | 34    | 49    | 91  | 123  |    |     |     | -5  | -5   | -20 | -40 | -40 |    |    |     |
| 03021206 | 8   | 16.7S  | 54.6E   | 65   | 8    | 29    | 85    | 125 | 146  |    |     |     | -10 | -30  | -50 | -45 | -40 |    |    |     |
| 03021218 | 9   | 18.0S  | 56.1E   | 85   | 23   | 80    | 127   | 150 | 156  |    |     |     | -10 | -30  | -30 | -25 | 5   |    |    |     |
| 03021306 | 10  | 19.4S  | 58.5E   | 105  | 0    | 49    | 87    | 103 | 124  |    |     |     | 0   | 15   | 20  | 50  | 55  |    |    |     |
| 03021318 | 11  | 21.5S  | 60.9E   | 100  | 5    | 27    | 60    | 89  |      |    |     |     | 0   | 0    | 30  | 45  |     |    |    |     |
| 03021400 | 12  | 22.6S  | 61.8E   | 100  | 0    | 27    | 64    | 106 |      |    |     |     | 0   | 10   | 45  | 45  |     |    |    |     |
| 03021412 | 13  | 24.7S  | 63.4E   | 75   | 12   | 20    | 48    |     |      |    |     |     | 0   | 25   | 15  |     |     |    |    |     |
| 03021500 | 14  | 26.4S  | 65.1E   | 35   | 34   | 6     |       |     |      |    |     |     | 0   | 5    |     |     |     |    |    |     |
| 03021512 | 15  | 27.9S  | 67.0E   | 30   | 12   |       |       |     |      |    |     |     | 5   |      |     |     |     |    |    |     |
|          |     |        | AVERAGE |      | 17   | 48    | 95    | 126 | 149  |    |     |     | 2   | 11   | 21  | 25  | 24  |    |    |     |
|          |     |        | BIAS    |      |      |       |       |     |      |    |     |     | -1  | 1    | 5   | 7   | 3   |    |    |     |
|          |     |        | # CASES |      | 15   | 14    | 13    | 12  | 10   |    |     |     | 15  | 14   | 13  | 12  | 10  |    |    |     |

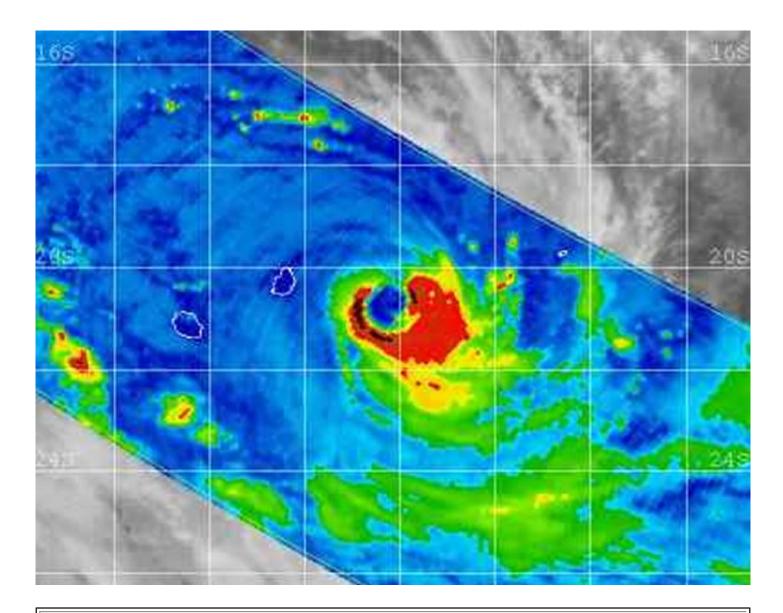
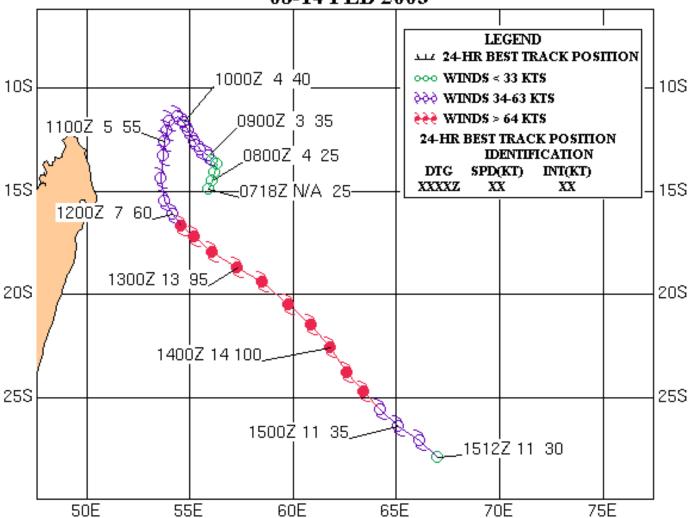
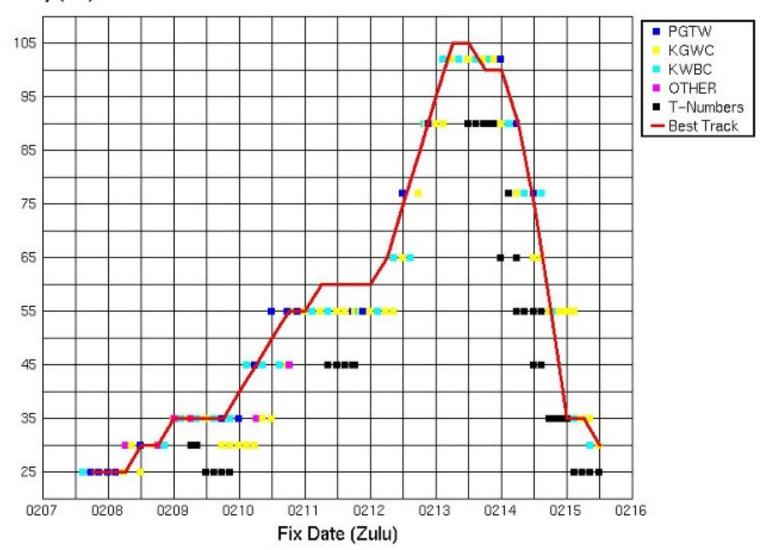


Figure 2-16S-1. 131228Z February 2003 85 GHz TRMM image of TC 16S (Gerry), 243 nm east of La Reunion island, with a peak intensity of 105 knots. The northern portion of the eye wall has just begun to weaken.

### TROPICAL CYCLONE 16S (GERRY) 08-14 FEB 2003



# Time Intensity for 16S



## **Tropical Cyclone (TC) 16S (Gerry)\***



First Poor: N/A

First Fair: 1800Z 07 Feb 03

First TCFA: 0630Z 08 Feb 03

First Warning: 1800Z 08 Feb 03

Last Warning: 1200Z 15 Feb 03, Dissipation

Max Intensity: 105 kts, gusts to 130 kts

Landfall: None

Total Warnings: 15

Remarks:

(1) Tropical Cyclone (TC) 16S developed approximately 430 Nm north-northwest of Mauritius within a well established monsoon trough consisting of 3 separate circulations that spanned across the South Indian Ocean. The other 2 circulations eventually became TCs 17S and 18S. Initially, TC 16S was caught in the weak equatorial steering flow of a low to mid level ridge to the southwest. TC 16S remained a weak system at the surface during this time, but maintained a well developed mid-level circulation. As the cyclone intensified, it made a quick turn south and curved towards the southeast as the steering ridge moved to the east of the system. TC 16S eventually went extratropical and JTWC issued the final warning on 15 February.

TC 16S reached a maximum intensity of 105 knots on 13 February when the upper level conditions improved and enhanced outflow into a mid-latitude trough. TC 16S passed within approximately 60 Nm northeast of Mauritius at its maximum intensity and weakened thereafter as it encountered increasing vertical wind shear.

TCs 16S, 17S, and 18S are an interesting case on how multiple TCs in one tropical basin behave and interact with each other in the open water. All systems developed at approximately the same latitude, yet displayed few signs of direct interaction through their life cycle.

(2) Reports indicated minimal damage on Mauritius with this system.

|          |     |       |         | Stati | isti | cs fo    | or JT | TWC | on ' | TC | 165 |     |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|----------|-------|-----|------|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      | <u> </u> |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
|          |     | BEST  | _       |       |      | SITIO    | _     |     |      |    |     |     | WIN | ID E |     |     |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12       | 24    | 36  | 48   | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020718 |     | 14.9S | 55.9E   | 25    |      |          |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020800 |     | 14.5S | 56.1E   | 25    |      |          |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020806 |     | 14.1S | 56.2E   | 25    |      |          |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020812 |     | 13.7S | 56.3E   | 30    |      |          |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03020818 | 1   | 13.5S | 56.1E   | 30    | 60   | 103      | 158   | 223 | 253  |    |     |     | 0   | 0    | 10  | 5   | 0   |    |    |     |
| 03020906 | 2   | 13.0S | 55.5E   | 35    | 0    | 32       | 105   | 116 | 127  |    |     |     | 0   | 10   | 10  | 10  | 15  |    |    |     |
| 03020918 | 3   | 12.1S | 54.9E   | 35    | 8    | 53       | 101   | 123 | 147  |    |     |     | 0   | 0    | -5  | 0   | 15  |    |    |     |
| 03021006 | 4   | 11.4S | 54.4E   | 45    | 13   | 60       | 118   | 168 | 189  |    |     |     | 0   | -5   | 0   | 15  | 30  |    |    |     |
| 03021018 | 5   | 12.1S | 53.9E   | 55    | 50   | 113      | 193   | 200 | 171  |    |     |     | 0   | 5    | 20  | 25  | 15  |    |    |     |
| 03021106 | 6   | 13.3S | 53.7E   | 60    | 0    | 44       | 38    | 19  | 57   |    |     |     | 0   | 15   | 20  | 0   | -25 |    |    |     |
| 03021118 | 7   | 15.5S | 53.8E   | 60    | 21   | 34       | 49    | 91  | 123  |    |     |     | -5  | -5   | -20 | -40 | -40 |    |    |     |
| 03021206 | 8   | 16.7S | 54.6E   | 65    | 8    | 29       | 85    | 125 | 146  |    |     |     | -10 | -30  | -50 | -45 | -40 |    |    |     |
| 03021218 | 9   | 18.0S | 56.1E   | 85    | 23   | 80       | 127   | 150 | 156  |    |     |     | -10 | -30  | -30 | -25 | 5   |    |    |     |
| 03021306 | 10  | 19.4S | 58.5E   | 105   | 0    | 49       | 87    | 103 | 124  |    |     |     | 0   | 15   | 20  | 50  | 55  |    |    |     |
| 03021318 | 11  | 21.5S | 60.9E   | 100   | 5    | 27       | 60    | 89  |      |    |     |     | 0   | 0    | 30  | 45  |     |    |    |     |
| 03021400 | 12  | 22.6S | 61.8E   | 100   | 0    | 27       | 64    | 106 |      |    |     |     | 0   | 10   | 45  | 45  |     |    |    |     |
| 03021412 | 13  | 24.7S | 63.4E   | 75    | 12   | 20       | 48    |     |      |    |     |     | 0   | 25   | 15  |     |     |    |    |     |
| 03021500 | 14  | 26.4S | 65.1E   | 35    | 34   | 6        |       |     |      |    |     |     | 0   | 5    |     |     |     |    |    |     |
| 03021512 | 15  | 27.9S | 67.0E   | 30    | 12   |          |       |     |      |    |     |     | 5   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 17   | 48       | 95    | 126 | 149  |    |     |     | 2   | 11   | 21  | 25  | 24  |    |    |     |
|          |     |       | BIAS    |       |      |          |       |     |      |    |     |     | -1  | 1    | 5   | 7   | 3   |    |    |     |
|          |     |       | # CASES |       | 15   | 14       | 13    | 12  | 10   |    |     |     | 15  | 14   | 13  | 12  | 10  |    |    |     |

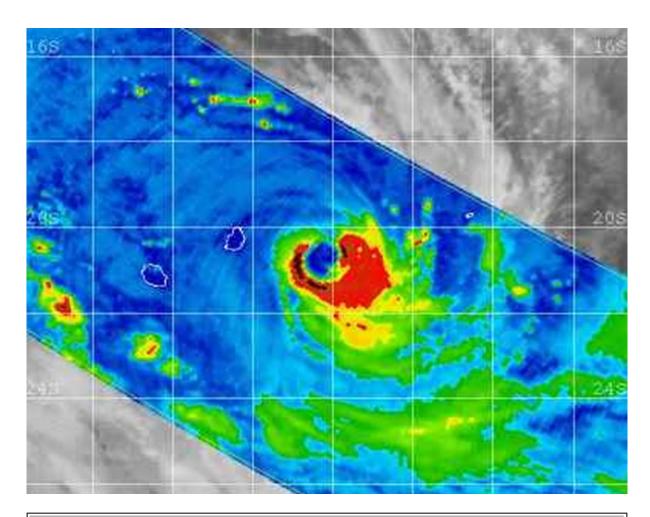
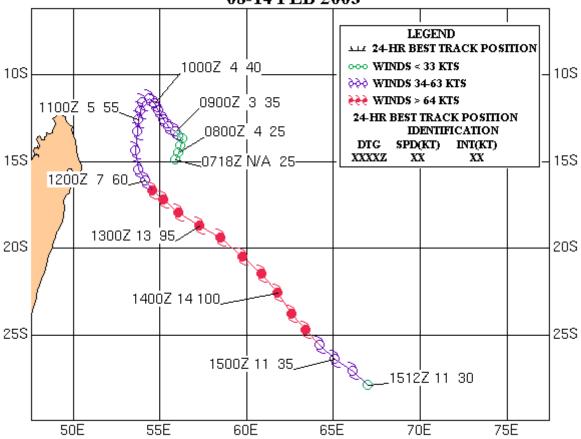
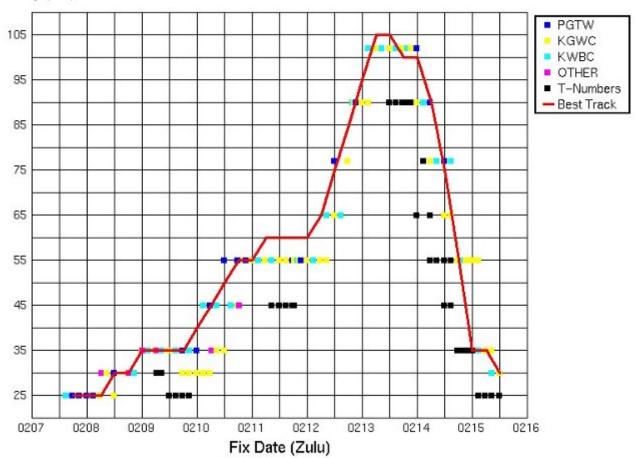


Figure 2-16S-1. 131228Z February 2003 85 GHz TRMM image of TC 16S (Gerry), 243 nm east of La Reunion island, with a peak intensity of 105 knots. The northern portion of the eye wall has just begun to weaken.

### TROPICAL CYCLONE 16S (GERRY) 08-14 FEB 2003



## Time Intensity for 16S



## Tropical Cyclone (TC) 17S (Hape)\*



First Poor: N/A

First Fair: 0630Z 09 Feb 03

First TCFA: 0530Z 10 Feb 03

First Warning: 1800Z 10 Feb 03

Last Warning: 1800Z 14 Feb 03, Dissipated

Max Intensity: 80 kts, gusts to 100 kts

Landfall: None

Total Warnings: 10

#### Remarks:

- (1) Tropical Cyclone (TC) 17S was first detected as a tropical disturbance on 09 February 2003 and was initially forecast by JTWC to interact with TC 16S. Such interaction didn't take place and by the second warning the primary steering influence was a near equatorial ridge situated to the northeast. The system intensified at a Dvorak T-number a day and then stabilized near 80 knots as the system tracked eastward, south of the ridge. Outflow was enhanced by passing short-wave troughs, enabling the cyclone to attain and then maintain this intensity for approximately 48 hours. TC 17S subsequently moved equatorward as the near equatorial ridge weakened until 13 February at 1800Z. Thereafter, a subtropical ridge developed to the northeast and caused the cyclone to track poleward where it dissipated under strong vertical wind shear.
- (2) No reports of damage caused by this cyclone were available.

## Statistics for JTWC on TC17S

|          | WRN | BEST  | TRACK   |      | PO | SITI | ON E | RRC | RS  |    |    |     | WIN | 1D E | RRC | DRS |     |    |    |     |
|----------|-----|-------|---------|------|----|------|------|-----|-----|----|----|-----|-----|------|-----|-----|-----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12   | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020906 |     | 12.0S | 65.9E   | 25   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03020912 |     | 12.4S | 65.5E   | 25   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03020918 |     | 12.8S | 65.1E   | 25   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03021000 |     | 13.4S | 64.9E   | 30   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03021006 |     | 14.0S | 64.7E   | 30   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03021012 |     | 14.6S | 64.5E   | 35   |    |      |      |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03021018 | 1   | 15.3S | 64.3E   | 40   | 18 | 50   | 181  | 385 | 629 |    |    |     | 0   | 0    | -25 | -50 | -45 |    |    |     |
| 03021106 | 2   | 16.8S | 64.4E   | 45   | 18 | 58   | 191  | 312 | 414 |    |    |     | 0   | -15  | -35 | -30 | -35 |    |    |     |
| 03021118 | 3   | 17.6S | 66.0E   | 75   | 8  | 79   | 170  | 276 | 382 |    |    |     | 0   | -15  | 5   | 10  | 10  |    |    |     |
| 03021206 | 4   | 17.0S | 68.0E   | 100  | 5  | 32   | 66   | 96  | 85  |    |    |     | -20 | 0    | 15  | 10  | 20  |    |    |     |
| 03021218 | 5   | 16.1S | 69.9E   | 90   | 34 | 66   | 74   | 36  | 31  |    |    |     | -15 | 0    | 5   | 25  | 30  |    |    |     |
| 03021306 | 6   | 15.1S | 71.0E   | 80   | 5  | 25   | 62   | 66  | 130 |    |    |     | 0   | 0    | 25  | 30  | 65  |    |    |     |
| 03021318 | 7   | 14.7S | 72.0E   | 80   | 5  | 78   | 127  | 207 |     |    |    |     | 0   | 20   | 15  | 35  |     |    |    |     |
| 03021406 | 8   | 15.8S | 73.2E   | 65   | 26 | 57   | 144  |     |     |    |    |     | 0   | -15  | 5   |     |     |    |    |     |
| 03021418 | 9   | 17.3S | 74.4E   | 65   | 36 | 102  |      |     |     |    |    |     | -5  | 15   |     |     |     |    |    |     |
| 03021506 | 10  | 20.0S | 76.4E   | 35   | 18 |      |      |     |     |    |    |     | 0   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |      | 18 | 61   | 127  | 197 | 279 |    |    |     | 4   | 9    | 16  | 27  | 34  |    |    |     |
|          |     |       | BIAS    |      |    |      |      |     |     |    |    |     | -4  | -1   | 1   | 4   | 8   |    |    |     |
|          |     |       | # CASES |      | 10 | 9    | 8    | 7   | 6   |    |    |     | 10  | 9    | 8   | 7   | 6   |    |    |     |

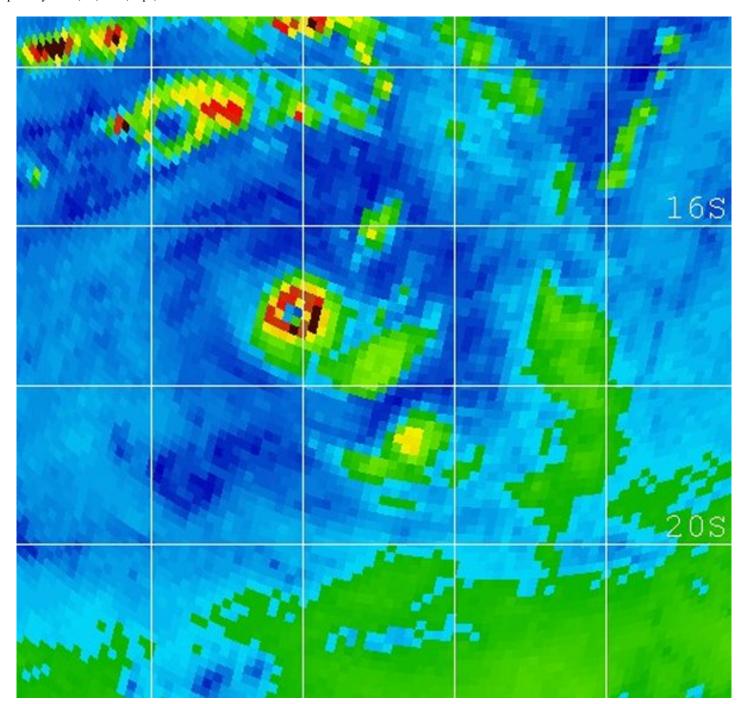
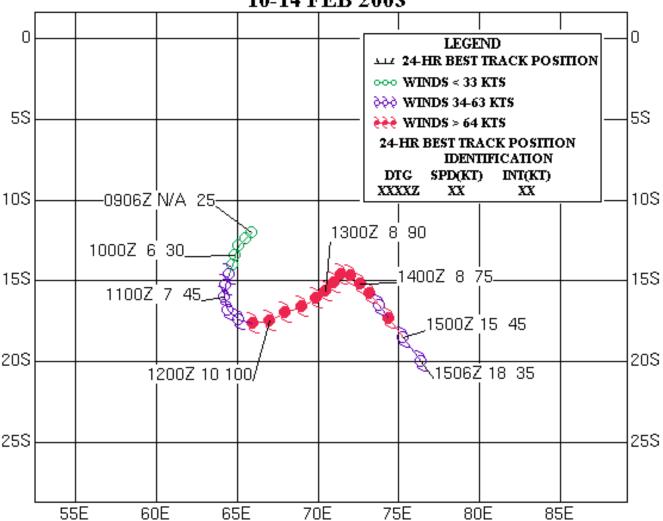
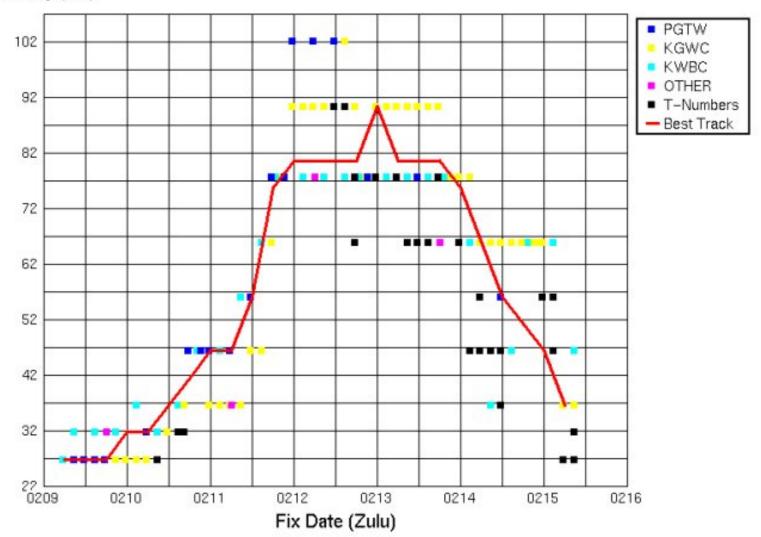


Figure 2-17S-1. 120438Z February 2003 85 GHz SSM/I imagery of TC 17S (Hape), 625 nm south-southwest of Diego Garcia, with a increasing intensity of 75 knots.

### TROPICAL CYCLONE 17S (HAPE) 10-14 FEB 2003



# Time Intensity for 17S



### **Tropical Cyclone (TC) 17S (Hape)\***



First Poor: N/A

First Fair: 0630Z 09 Feb 03

First TCFA: 0530Z 10 Feb 03

First Warning: 1800Z 10 Feb 03

Last Warning: 1800Z 14 Feb 03, Dissipated

Max Intensity: 80 kts, gusts to 100 kts

Landfall: None

Total Warnings: 10

#### Remarks:

- (1) Tropical Cyclone (TC) 17S was first detected as a tropical disturbance on 09 February 2003 and was initially forecast by JTWC to interact with TC 16S. Such interaction didn't take place and by the second warning the primary steering influence was a near equatorial ridge situated to the northeast. The system intensified at a Dvorak T-number a day and then stabilized near 80 knots as the system tracked eastward, south of the ridge. Outflow was enhanced by passing short-wave troughs, enabling the cyclone to attain and then maintain this intensity for approximately 48 hours. TC 17S subsequently moved equatorward as the near equatorial ridge weakened until 13 February at 1800Z. Thereafter, a subtropical ridge developed to the northeast and caused the cyclone to track poleward where it dissipated under strong vertical wind shear.
- (2) No reports of damage caused by this cyclone were available.

|          |     |       |         | Stati | isti | cs fo | or Jī | ΓWC | on  | TC | 178 | ;   |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|-------|-------|-----|-----|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | РО   | SITI  | ON E  | RRC | RS  |    |     |     | WIN | ND E | RRO | DRS |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12    | 24    | 36  | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03020906 |     | 12.0S | 65.9E   | 25    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020912 |     | 12.4S | 65.5E   | 25    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03020918 |     | 12.8S | 65.1E   | 25    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03021000 |     | 13.4S | 64.9E   | 30    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03021006 |     | 14.0S | 64.7E   | 30    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03021012 |     | 14.6S | 64.5E   | 35    |      |       |       |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03021018 | 1   | 15.3S | 64.3E   | 40    | 18   | 50    | 181   | 385 | 629 |    |     |     | 0   | 0    | -25 | -50 | -45 |    |    |     |
| 03021106 | 2   | 16.8S | 64.4E   | 45    | 18   | 58    | 191   | 312 | 414 |    |     |     | 0   | -15  | -35 | -30 | -35 |    |    |     |
| 03021118 | 3   | 17.6S | 66.0E   | 75    | 8    | 79    | 170   | 276 | 382 |    |     |     | 0   | -15  | 5   | 10  | 10  |    |    |     |
| 03021206 | 4   | 17.0S | 68.0E   | 100   | 5    | 32    | 66    | 96  | 85  |    |     |     | -20 | 0    | 15  | 10  | 20  |    |    |     |
| 03021218 | 5   | 16.1S | 69.9E   | 90    | 34   | 66    | 74    | 36  | 31  |    |     |     | -15 | 0    | 5   | 25  | 30  |    |    |     |
| 03021306 | 6   | 15.1S | 71.0E   | 80    | 5    | 25    | 62    | 66  | 130 |    |     |     | 0   | 0    | 25  | 30  | 65  |    |    |     |
| 03021318 | 7   | 14.7S | 72.0E   | 80    | 5    | 78    | 127   | 207 |     |    |     |     | 0   | 20   | 15  | 35  |     |    |    |     |
| 03021406 | 8   | 15.8S | 73.2E   | 65    | 26   | 57    | 144   |     |     |    |     |     | 0   | -15  | 5   |     |     |    |    |     |
| 03021418 | 9   | 17.3S | 74.4E   | 65    | 36   | 102   |       |     |     |    |     |     | -5  | 15   |     |     |     |    |    |     |
| 03021506 | 10  | 20.0S | 76.4E   | 35    | 18   |       |       |     |     |    |     |     | 0   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 18   | 61    | 127   | 197 | 279 |    |     |     | 4   | 9    | 16  | 27  | 34  |    |    |     |
|          |     |       | BIAS    |       |      |       |       |     |     |    |     |     | -4  | -1   | 1   | 4   | 8   |    |    |     |
|          |     |       | # CASES |       | 10   | 9     | 8     | 7   | 6   |    |     |     | 10  | 9    | 8   | 7   | 6   |    |    |     |

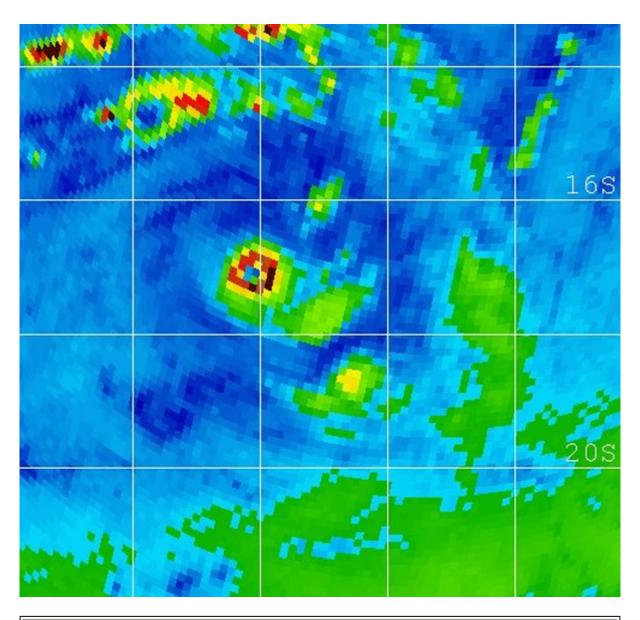
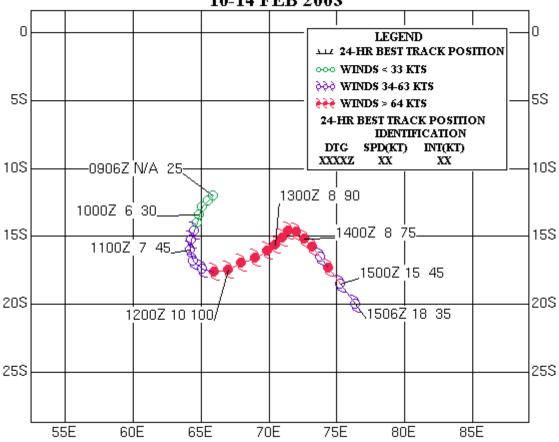
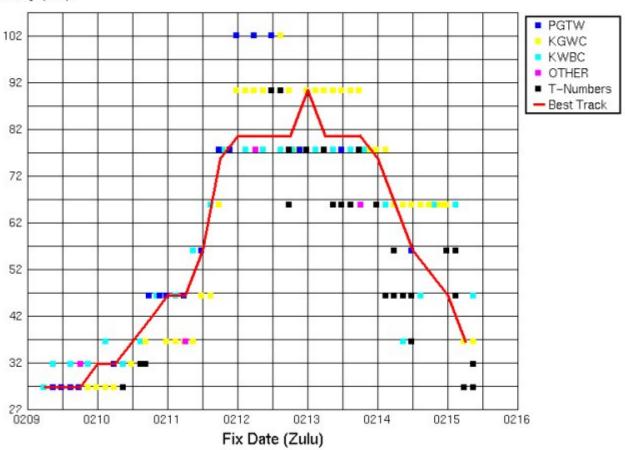


Figure 2-17S-1. 120438Z February 2003 85 GHz SSM/I imagery of TC 17S (Hape), 625 nm south-southwest of Diego Garcia, with a increasing intensity of 75 knots.

### TROPICAL CYCLONE 17S (HAPE) 10-14 FEB 2003



# Time Intensity for 17S



## Tropical Cyclone (TC) 18S (Isha)\*



First Poor: 1800Z 03 Feb 03

First Fair: 0330Z 04 Feb 03

First TCFA: 2000Z 04 Feb 03

First Warning: 0000Z 11 Feb 03

Last Warning: 0000Z 14 Feb 03, Dissipated

Max Intensity: 45 kts, gusts to 55 kts

Landfall: None

Total Warnings: 7

Remarks:

(1) Tropical Cyclone (TC) 18S developed approximately 200 nm northeast of Cocos Island on 03 February at 1800Z. The cyclone tracked westward until 09 February at 0600Z and then altered track towards the southwest. The first warning was issued on 11 February at 0000Z when TC 18S was approximately 900 nm west of Cocos Island. The cyclone then turned southeast as it passed poleward of the ridge axis.

TC 18S reached a maximum intensity of only 45 kts by February 13 at 0000Z. The final warning for the cyclone was issued on February 14 as it dissipated over open ocean.

(2) No damage reports were received for TC 18S.

|          |     |       | ;     | Statis | tic | s fo | r JT  | WC ( | on T | C18 | 3S |     |    |    |     |     |    |    |    |     |
|----------|-----|-------|-------|--------|-----|------|-------|------|------|-----|----|-----|----|----|-----|-----|----|----|----|-----|
|          |     |       |       |        |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
|          | WRN | BEST  | TRACK |        | PO  | SIT  | ION I | ERRO | DRS  |     |    |     | WI | ND | ERF | ROF | S  |    |    |     |
| DTG      | NO. | LAT   | LONG  | wind   | 00  | 12   | 24    | 36   | 48   | 72  | 96 | 120 | 00 | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03020318 |     | 9.8S  | 99.2E | 15     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020400 |     | 10.2S | 99.0E | 15     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020406 |     | 10.6S | 98.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020412 |     | 10.8S | 98.2E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020418 |     | 10.9S | 97.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020500 |     | 11.0S | 97.2E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020506 |     | 11.1S | 96.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020512 |     | 11.1S | 96.2E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020518 |     | 11.2S | 95.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020600 |     | 11.2S | 95.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020606 |     | 11.1S | 94.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020612 |     | 10.7S | 93.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020618 |     | 10.2S | 92.2E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020700 |     | 9.7S  | 91.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020706 |     | 9.6S  | 91.3E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020712 |     | 9.4S  | 91.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020718 |     | 9.4S  | 90.5E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020800 |     | 9.4S  | 90.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020806 |     | 9.5S  | 89.1E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020812 |     | 9.6S  | 88.2E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020818 |     | 9.7S  | 87.3E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020900 |     | 9.98  | 86.6E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020906 |     | 10.1S | 85.9E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020912 |     | 10.5S | 85.3E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03020918 |     | 10.8S | 84.7E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03021000 |     | 11.1S | 84.0E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03021006 |     | 11.6S | 83.1E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03021012 |     | 12.3S | 82.4E | 25     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03021018 |     | 13.1S | 81.8E | 30     |     |      |       |      |      |     |    |     |    |    |     |     |    |    |    |     |
| 03021100 | 1   | 14.0S | 81.2E | 30     | 0   | 65   | 139   | 185  | 201  |     |    |     | 0  | 10 | 5   | 10  | 10 |    |    |     |

| 03021112 | 2 | 15.5S | 81.6E   | 30 | 21 | 73 | 114 | 158 | 215 |  | 0 | -5 | 0  | 0  | 5  |  |  |
|----------|---|-------|---------|----|----|----|-----|-----|-----|--|---|----|----|----|----|--|--|
| 03021200 | 3 | 16.4S | 82.7E   | 40 | 0  | 18 | 34  | 95  | 92  |  | 0 | 5  | 5  | 10 | 25 |  |  |
| 03021212 | 4 | 17.1S | 83.6E   | 40 | 41 | 85 | 120 | 74  | 57  |  | 0 | 0  | 5  | 15 | 20 |  |  |
| 03021300 | 5 | 18.1S | 84.4E   | 45 | 24 | 83 | 85  | 73  |     |  | 0 | 5  | 20 | 25 |    |  |  |
| 03021312 | 6 | 20.0S | 85.4E   | 45 | 8  | 98 | 228 |     |     |  | 0 | 5  | -5 |    |    |  |  |
| 03021400 | 7 | 21.0S | 85.2E   | 35 | 28 | 96 |     |     |     |  | 0 | -5 |    |    |    |  |  |
| 03021406 |   | 20.5S | 84.5E   | 35 |    |    |     |     |     |  |   |    |    |    |    |  |  |
| 03021412 |   | 20.5S | 85.4E   | 35 |    |    |     |     |     |  |   |    |    |    |    |  |  |
|          |   |       | AVERAGE |    | 18 | 74 | 120 | 117 | 141 |  | 0 | 5  | 7  | 12 | 15 |  |  |
|          |   |       | BIAS    |    |    |    |     |     |     |  | 0 | 2  | 5  | 12 | 15 |  |  |
|          |   |       | # CASES |    | 7  | 7  | 6   | 5   | 4   |  | 7 | 7  | 6  | 5  | 4  |  |  |

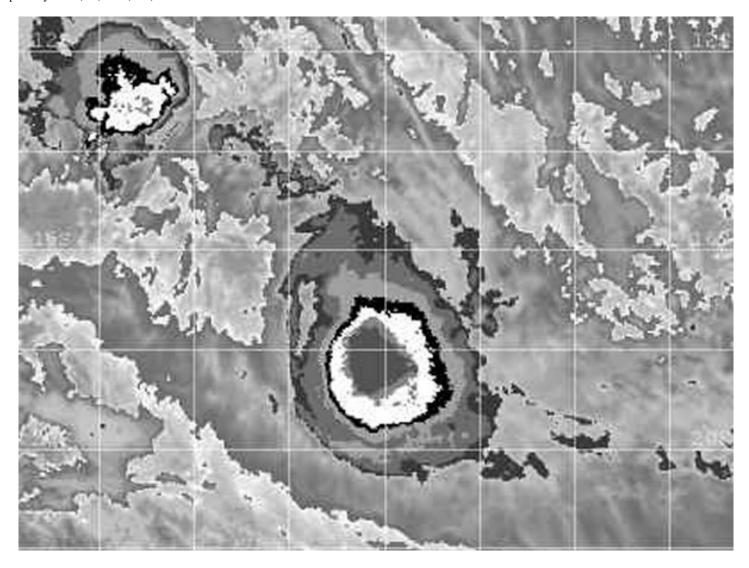
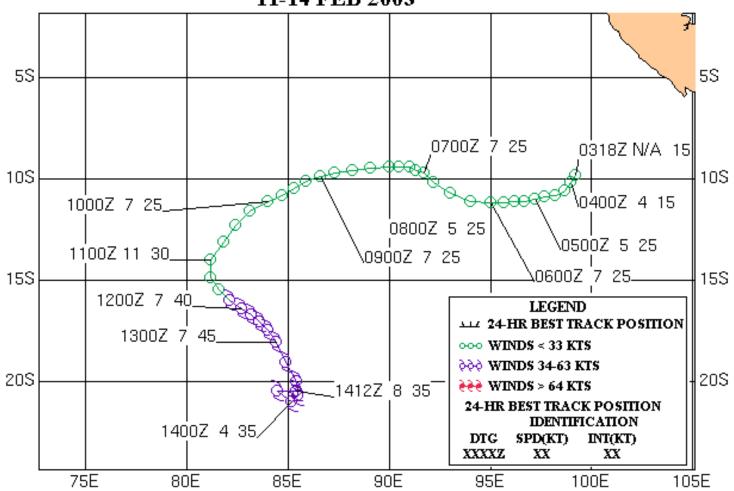
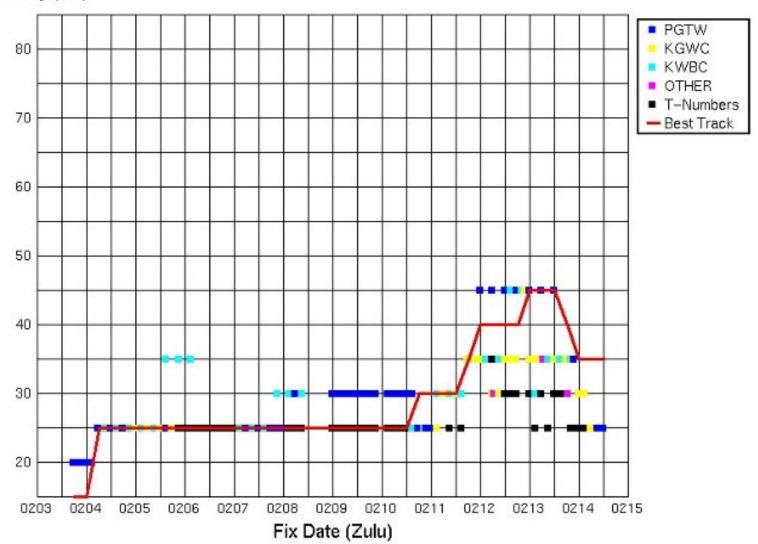


Figure 2-18S-1. 121730Z February 2003 Met-5 enhanced infrared image of TC 18S (Isha), 791 nm southwest of Cocos island, with a maximum intensity of 45 knots.

### TROPICAL CYCLONE 18S (ISHA) 11-14 FEB 2003



# Time Intensity for 18S



## Tropical Cyclone (TC) 18S (Isha)\*



First Poor: 1800Z 03 Feb 03

First Fair: 0330Z 04 Feb 03

First TCFA: 2000Z 04 Feb 03

First Warning: 0000Z 11 Feb 03

Last Warning: 0000Z 14 Feb 03, Dissipated

Max Intensity: 45 kts, gusts to 55 kts

Landfall: None

Total Warnings: 7

Remarks:

(1) Tropical Cyclone (TC) 18S developed approximately 200 nm northeast of Cocos Island on 03 February at 1800Z. The cyclone tracked westward until 09 February at 0600Z and then altered track towards the southwest. The first warning was issued on 11 February at 0000Z when TC 18S was approximately 900 nm west of Cocos Island. The cyclone then turned southeast as it passed poleward of the ridge axis.

TC 18S reached a maximum intensity of only 45 kts by February 13 at 0000Z. The final warning for the cyclone was issued on February 14 as it dissipated over open ocean.

(2) No damage reports were received for TC 18S.

|          |     |       | :     | Statis | tics | s fo | r JT       | WC ( | on T | C18 | BS |     |     |    |     |     |    |     |    |     |
|----------|-----|-------|-------|--------|------|------|------------|------|------|-----|----|-----|-----|----|-----|-----|----|-----|----|-----|
|          |     |       |       |        |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
|          | WRN | BEST  | TRACK |        | PΩ   | SIT  | ION I      | ERRO | ORS  |     |    |     | WII | ND | ERF | ROF | 2S |     |    |     |
| DTG      | NO. | LAT   | LONG  | wind   |      | 12   |            | 36   | 48   | 72  | 96 | 120 |     |    |     |     |    | 72  | 96 | 120 |
| 03020318 |     | 9.8S  | 99.2E | 15     |      | -    | <u>-</u> · |      |      | -   |    | 120 |     |    |     |     |    | · = |    |     |
| 03020400 |     | 10.2S | 99.0E | 15     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020406 |     |       | 98.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020412 |     | 10.8S | 98.2E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020418 |     | 10.9S | 97.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020500 |     | 11.0S | 97.2E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020506 |     | 11.1S | 96.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020512 |     | 11.1S | 96.2E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020518 |     | 11.2S | 95.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020600 |     | 11.2S | 95.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020606 |     | 11.1S | 94.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020612 |     | 10.7S | 93.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020618 |     | 10.2S | 92.2E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020700 |     | 9.7S  | 91.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020706 |     | 9.6S  | 91.3E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020712 |     | 9.4S  | 91.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020718 |     | 9.4S  | 90.5E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020800 |     | 9.4S  | 90.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020806 |     | 9.5S  | 89.1E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020812 |     | 9.6S  | 88.2E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020818 |     | 9.7S  | 87.3E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020900 |     | 9.9S  | 86.6E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020906 |     | 10.1S | 85.9E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020912 |     | 10.5S | 85.3E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03020918 |     | 10.8S | 84.7E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03021000 |     | 11.1S | 84.0E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03021006 |     | 11.6S | 83.1E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03021012 |     | 12.3S | 82.4E | 25     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03021018 |     | 13.1S | 81.8E | 30     |      |      |            |      |      |     |    |     |     |    |     |     |    |     |    |     |
| 03021100 | 1   | 14.0S | 81.2E | 30     | 0    | 65   | 139        | 185  | 201  |     |    |     | 0   | 10 | 5   | 10  | 10 |     |    |     |
| 03021112 | 2   | 15.5S | 81.6E | 30     | 21   | 73   | 114        | 158  | 215  |     |    |     | 0   | -5 | 0   | 0   | 5  |     |    |     |
| 03021200 | 3   | 16.4S | 82.7E | 40     | 0    | 18   | 34         | 95   | 92   |     |    |     | 0   | 5  | 5   | 10  | 25 |     |    |     |
| 03021212 | 4   | 17.1S | 83.6E | 40     | 41   | 85   | 120        | 74   | 57   |     |    |     | 0   | 0  | 5   | 15  | 20 |     |    |     |
| 03021300 | 5   | 18.1S | 84.4E | 45     | 24   | 83   | 85         | 73   |      |     |    |     | 0   | 5  | 20  | 25  |    |     |    |     |

| 03021312 | 6 | 20.0S | 85.4E   | 45 | 8  | 98 | 228 |     |     |  | 0 | 5  | -5 |    |    |  |  |
|----------|---|-------|---------|----|----|----|-----|-----|-----|--|---|----|----|----|----|--|--|
| 03021400 | 7 | 21.0S | 85.2E   | 35 | 28 | 96 |     |     |     |  | 0 | -5 |    |    |    |  |  |
| 03021406 |   | 20.5S | 84.5E   | 35 |    |    |     |     |     |  |   |    |    |    |    |  |  |
| 03021412 |   | 20.5S | 85.4E   | 35 |    |    |     |     |     |  |   |    |    |    |    |  |  |
|          |   |       | AVERAGE |    | 18 | 74 | 120 | 117 | 141 |  | 0 | 5  | 7  | 12 | 15 |  |  |
|          |   |       | BIAS    |    |    |    |     |     |     |  | 0 | 2  | 5  | 12 | 15 |  |  |
|          |   |       | # CASES |    | 7  | 7  | 6   | 5   | 4   |  | 7 | 7  | 6  | 5  | 4  |  |  |

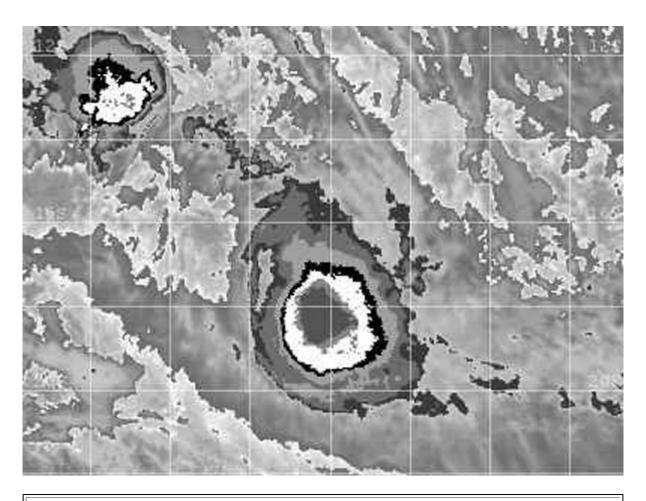
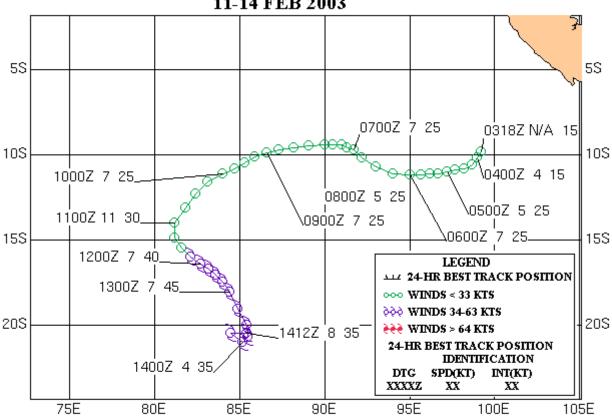
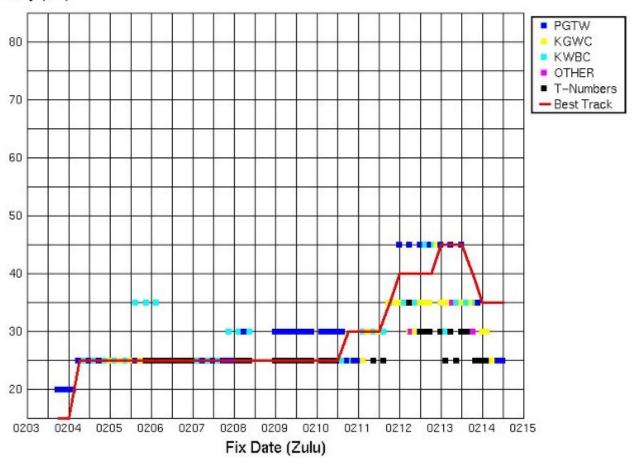


Figure 2-18S-1. 121730Z February 2003 Met-5 enhanced infrared image of TC 18S (Isha), 791 nm southwest of Cocos island, with a maximum intensity of 45 knots.

### TROPICAL CYCLONE 18S (ISHA) 11-14 FEB 2003



## Time Intensity for 18S



# Tropical Cyclone (TC) 19S (Japhet)\*



First Poor: 1800Z 23 Feb 03

First Fair: 1800Z 24 Feb 03

First TCFA: 2100Z 25 Feb 03

First Warning: 0000Z 26 Feb 03

Last Warning: 1200Z 03 Mar 03, Dissipated

Max Intensity: 115 kts, gusts to 140 kts

Landfall: South of Vilanculos, Mozambique on 02 March at approx 1700Z with intensity of 85

knots.

Total Warnings: 12

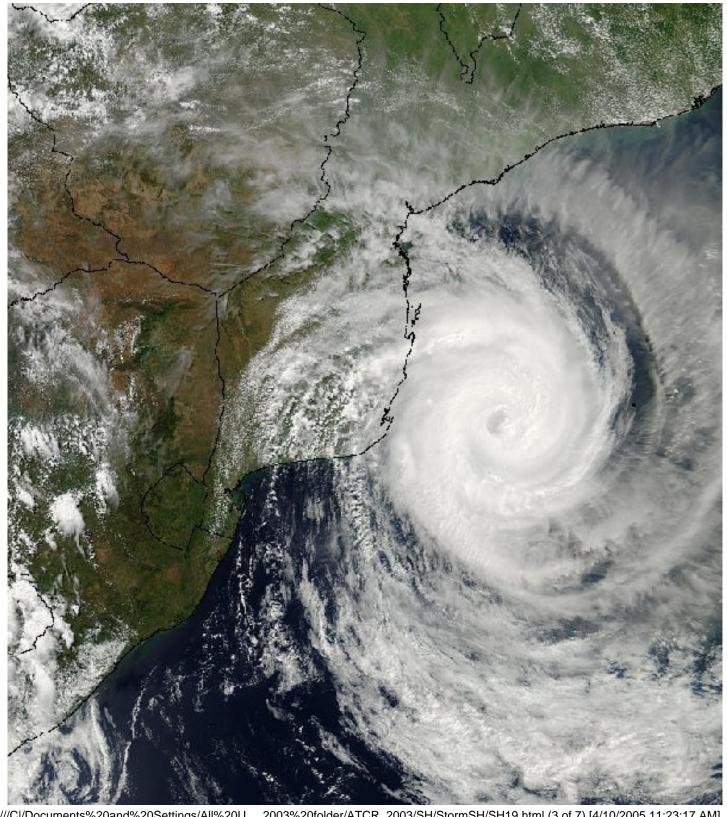
Remarks:

(1) Tropical Cyclone (TC) 19S formed off the southwestern coast of Madagascar in the warm tropical waters of the Mozambique Channel. Initially, the cyclone was located in a weak steering environment, drifting slowly southward as it consolidated. The approach of a transitory ridge from the southwest altered the track west, followed by a weakness in the ridge which altered the track southwestward and provided an improved upper level environment for intensification. TC 19S attained a maximum intensity of 115 knots by 01 March and maintained this intensity for almost 24 hours.

TC 19S made landfall on 02 March at approximately 1700Z just south of Vilanculos, Mozambique with an intensity of 85 knots. They cyclone then weakened rapidly as it moved onto land on a westward track. The remnants of TC 19S then drifted into central Zimbabwe and dissipated.

(2) The intense winds and torrential rains caused by TC 19S damaged infrastructure across southern and central Mozambique and regions of southern and eastern Zimbabwe. News accounts reported a total of 19 fatalities. The heavy tropical rains brought widespread flooding to the Save River basin. On a positive note, remnants of TC 19S brought much needed moisture to many areas in the region that had been experiencing drought.

|          |     |        |         | Stati | stic | s f | or J | ΓWC | on  | TC | 198 | ;   |    |      |     |     |       |    |    |     |
|----------|-----|--------|---------|-------|------|-----|------|-----|-----|----|-----|-----|----|------|-----|-----|-------|----|----|-----|
|          |     |        |         |       |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
|          | WRN | BEST 1 | ΓRACK   |       | PC   | SIT | ION  | ERR | ORS | ,  |     |     | WI | ND E | ERR | ORS | ;<br> |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind  | 00   | 12  | 24   | 36  | 48  | 72 | 96  | 120 | 00 | 12   | 24  | 36  | 48    | 72 | 96 | 120 |
| 03022412 |     | 21.4S  | 42.3E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022418 |     | 21.2S  | 42.6E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022500 |     | 21.4S  | 42.9E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022506 |     | 21.7S  | 42.8E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022512 |     | 22.1S  | 42.7E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022518 |     | 22.4S  | 42.4E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03022600 | 1   | 22.3S  | 41.5E   | 30    | 40   | 95  | 88   | 77  | 81  |    |     |     | 0  | 0    | -5  | -20 | -15   |    |    |     |
| 03022612 | 2   | 21.6S  | 39.8E   | 35    | 12   | 64  | 104  | 124 | 151 |    |     |     | 0  | 0    | -10 | -15 | -15   |    |    |     |
| 03022700 | 3   | 21.4S  | 39.2E   | 45    | 8    | 49  | 63   | 102 | 187 |    |     |     | 0  | -10  | -10 | -10 | -65   |    |    |     |
| 03022712 | 4   | 21.9S  | 38.7E   | 65    | 8    | 11  | 8    | 77  | 162 |    |     |     | -5 | -5   | -10 | -45 | -65   |    |    |     |
| 03022800 | 5   | 22.5S  | 38.0E   | 75    | 30   | 26  | 42   | 63  | 50  |    |     |     | 0  | 0    | -25 | -20 | -15   |    |    |     |
| 03022812 | 6   | 23.2S  | 37.6E   | 85    | 5    | 16  | 37   | 48  | 94  |    |     |     | 0  | -25  | -20 | -15 | 0     |    |    |     |
| 03030100 | 7   | 23.9S  | 37.6E   | 115   | 0    | 30  | 90   | 183 | 240 |    |     |     | 0  | 0    | 5   | 15  | 35    |    |    |     |
| 03030112 | 8   | 23.6S  | 37.6E   | 115   | 6    | 49  | 95   | 107 | 127 |    |     |     | 0  | 10   | 15  | 30  | 30    |    |    |     |
| 03030200 | 9   | 23.0S  | 36.9E   | 105   | 8    | 57  | 86   | 110 | 130 |    |     |     | 0  | 5    | 25  | 20  | 10    |    |    |     |
| 03030212 | 10  | 22.1S  | 35.7E   | 90    | 8    | 19  | 37   | 66  |     |    |     |     | -5 | 10   | 5   | -5  |       |    |    |     |
| 03030300 | 11  | 21.3S  | 34.7E   | 65    | 8    | 17  | 48   |     |     |    |     |     | -5 | -15  | -20 |     |       |    |    |     |
| 03030312 | 12  | 20.8S  | 33.4E   | 60    | 11   | 42  |      |     |     |    |     |     | -5 | -15  |     |     |       |    |    |     |
| 03030318 |     | 20.3S  | 32.9E   | 55    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
| 03030400 |     | 19.8S  | 32.5E   | 55    |      |     |      |     |     |    |     |     |    |      |     |     |       |    |    |     |
|          |     |        | AVERAGE |       | 12   | 40  | 63   | 96  | 136 |    |     |     | 2  | 8    | 14  | 20  | 28    |    |    |     |
|          |     |        | BIAS    |       |      |     |      |     |     |    |     |     | -2 | -4   | -5  | -7  | -11   |    |    |     |
|          |     |        | # CASES |       | 12   | 12  | 11   | 10  | 9   |    |     |     | 12 | 12   | 11  | 10  | 9     |    |    |     |



 $file: ///C|/Documents\%20 and\%20 Settings/All\%20 U...\_2003\%20 folder/ATCR\_2003/SH/StormSH/SH19. html (3 of 7)~[4/10/2005~11:23:17~AM]$ 



Figure 2-19S-1. 281140Z February 2003 MODIS true-color image of TC 19S (Japhet), located in the Mozambique Channel, with an intensity of 85 knots.

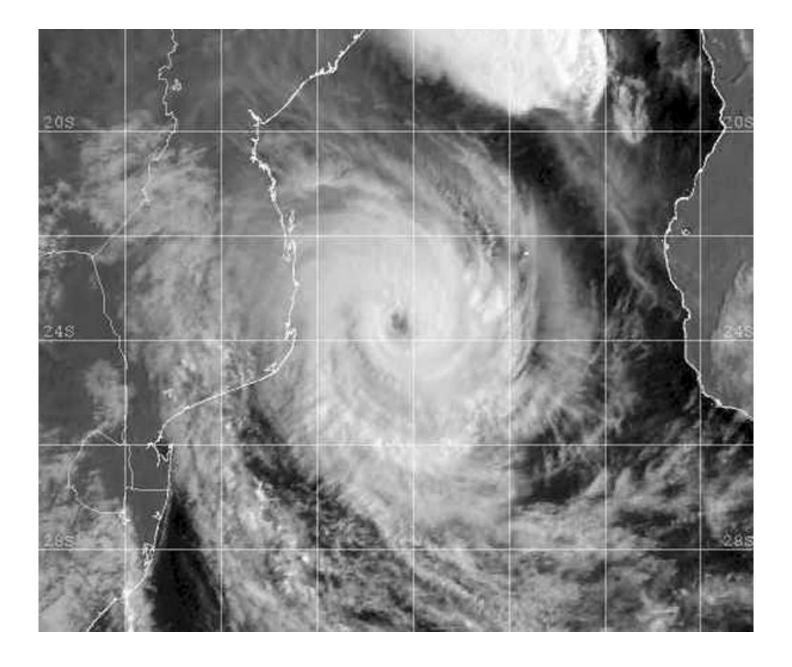


Figure 2-19S-2. 010600Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, with a maximum intensity of 115 knots.

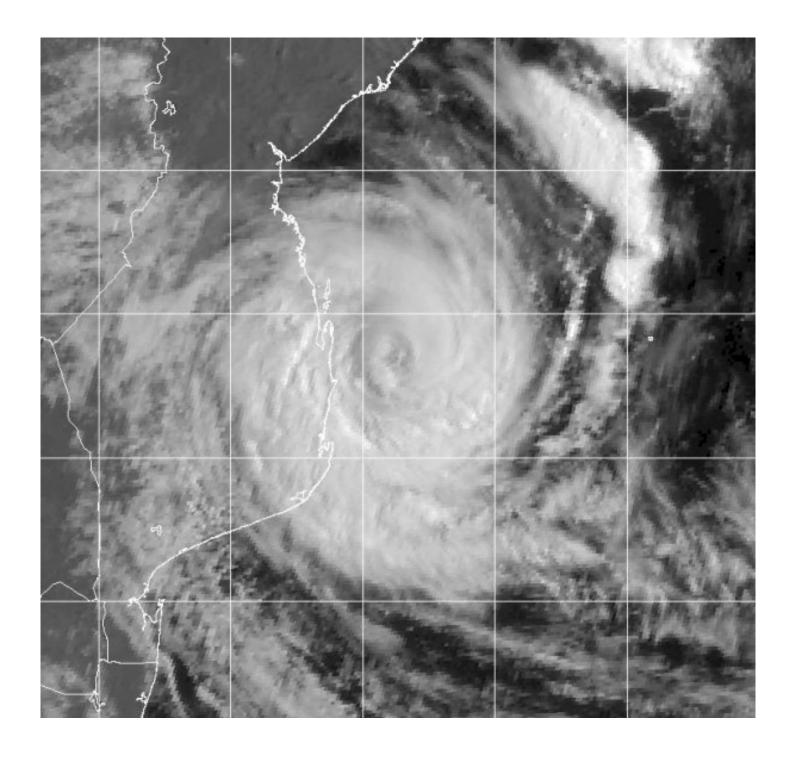
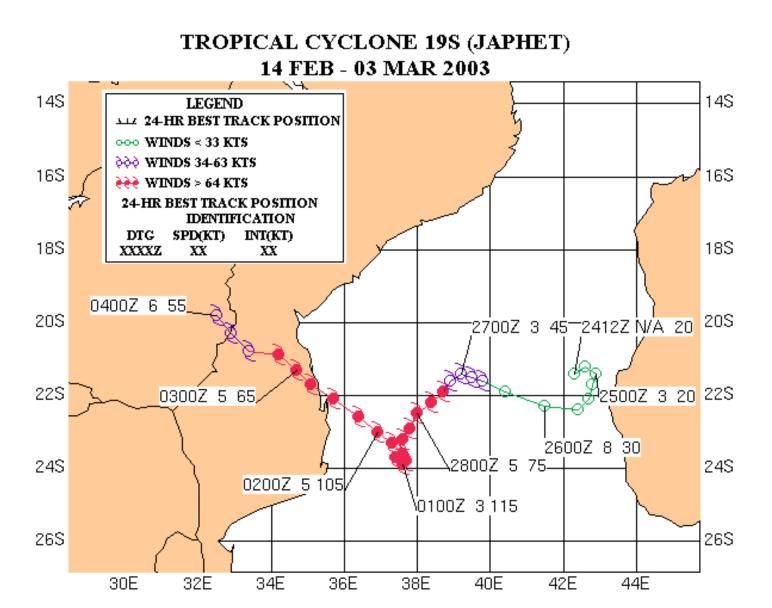


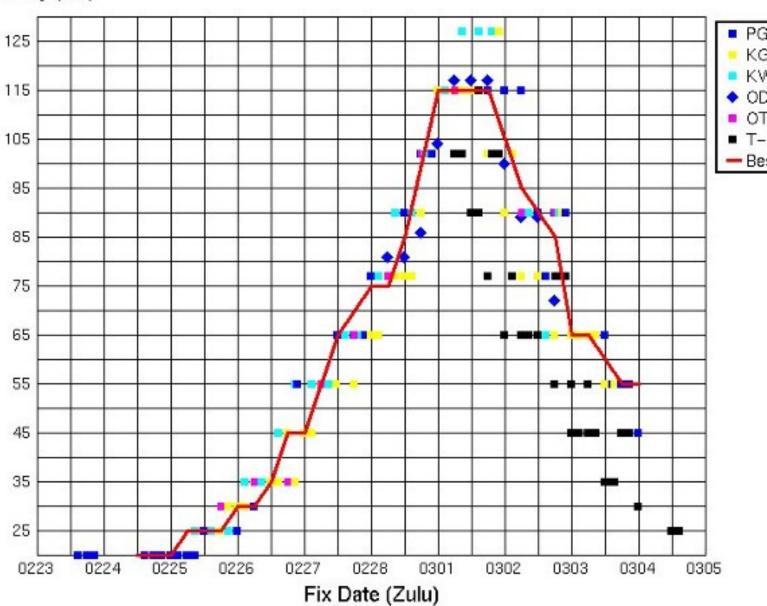
Figure 2-19S-3. 020630Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, just prior to landfall with an intensity of 95 knots.



# Time Intensity for 19S

KG

OD OT



### Tropical Cyclone (TC) 19S (Japhet)\*



First Poor : 1800Z 23 Feb 03

First Fair: 1800Z 24 Feb 03

First TCFA: 2100Z 25 Feb 03

First Warning: 0000Z 26 Feb 03

Last Warning: 1200Z 03 Mar 03, Dissipated

Max Intensity: 115 kts, gusts to 140 kts

Landfall: South of Vilanculos, Mozambique on 02 March at approx 1700Z with intensity of 85

knots.

Total Warnings: 12

Remarks:

(1) Tropical Cyclone (TC) 19S formed off the southwestern coast of Madagascar in the warm tropical waters of the Mozambique Channel. Initially, the cyclone was located in a weak steering environment, drifting slowly southward as it consolidated. The approach of a transitory ridge from the southwest altered the track west, followed by a weakness in the ridge which altered the track southwestward and provided an improved upper level environment for intensification. TC 19S attained a maximum intensity of 115 knots by 01 March and maintained this intensity for almost 24 hours.

TC 19S made landfall on 02 March at approximately 1700Z just south of Vilanculos, Mozambique with an intensity of 85 knots. They cyclone then weakened rapidly as it moved onto land on a westward track. The remnants of TC 19S then drifted into central Zimbabwe and dissipated.

(2) The intense winds and torrential rains caused by TC 19S damaged infrastructure across southern and central Mozambique and regions of southern and eastern Zimbabwe. News accounts reported a total of 19 fatalities. The heavy tropical rains brought widespread flooding to the Save River basin. On a positive note, remnants of TC 19S brought much needed moisture to many areas in the region that had been experiencing drought.

|          |     |       |         | Stati | stic | s f | or J | ΓWC | on  | TC | 19S | ;   |    |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|-----|------|-----|-----|----|-----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |     |      |     |     |    |     |     | ,  |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PO   | SIT | ION  | ERR | ORS |    |     |     | WI | ND E | ERR | ORS |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12  | 24   | 36  | 48  | 72 | 96  | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03022412 |     | 21.4S | 42.3E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022418 |     | 21.2S | 42.6E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022500 |     | 21.4S | 42.9E   | 20    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022506 |     | 21.7S | 42.8E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022512 |     | 22.1S | 42.7E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022518 |     | 22.4S | 42.4E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03022600 | 1   | 22.3S | 41.5E   | 30    | 40   | 95  | 88   | 77  | 81  |    |     |     | 0  | 0    | -5  | -20 | -15 |    |    |     |
| 03022612 | 2   | 21.6S | 39.8E   | 35    | 12   | 64  | 104  | 124 | 151 |    |     |     | 0  | 0    | -10 | -15 | -15 |    |    |     |
| 03022700 | 3   | 21.4S | 39.2E   | 45    | 8    | 49  | 63   | 102 | 187 |    |     |     | 0  | -10  | -10 | -10 | -65 |    |    |     |
| 03022712 | 4   | 21.9S | 38.7E   | 65    | 8    | 11  | 8    | 77  | 162 |    |     |     | -5 | -5   | -10 | -45 | -65 |    |    |     |
| 03022800 | 5   | 22.5S | 38.0E   | 75    | 30   | 26  | 42   | 63  | 50  |    |     |     | 0  | 0    | -25 | -20 | -15 |    |    |     |
| 03022812 | 6   | 23.2S | 37.6E   | 85    | 5    | 16  | 37   | 48  | 94  |    |     |     | 0  | -25  | -20 | -15 | 0   |    |    |     |
| 03030100 | 7   | 23.9S | 37.6E   | 115   | 0    | 30  | 90   | 183 | 240 |    |     |     | 0  | 0    | 5   | 15  | 35  |    |    |     |
| 03030112 | 8   | 23.6S | 37.6E   | 115   | 6    | 49  | 95   | 107 | 127 |    |     |     | 0  | 10   | 15  | 30  | 30  |    |    |     |
| 03030200 | 9   | 23.0S | 36.9E   | 105   | 8    | 57  | 86   | 110 | 130 |    |     |     | 0  | 5    | 25  | 20  | 10  |    |    |     |
| 03030212 | 10  | 22.1S | 35.7E   | 90    | 8    | 19  | 37   | 66  |     |    |     |     | -5 | 10   | 5   | -5  |     |    |    |     |
| 03030300 | 11  | 21.3S | 34.7E   | 65    | 8    | 17  | 48   |     |     |    |     |     | -5 | -15  | -20 |     |     |    |    |     |
| 03030312 | 12  | 20.8S | 33.4E   | 60    | 11   | 42  |      |     |     |    |     |     | -5 | -15  |     |     |     |    |    |     |
| 03030318 |     | 20.3S | 32.9E   | 55    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
| 03030400 |     | 19.8S | 32.5E   | 55    |      |     |      |     |     |    |     |     |    |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 12   | 40  | 63   | 96  | 136 |    |     |     | 2  | 8    | 14  | 20  | 28  |    |    |     |
|          |     |       | BIAS    |       |      |     |      |     |     |    |     |     | -2 | -4   | -5  | -7  | -11 |    |    |     |
|          |     |       | # CASES |       | 12   | 12  | 11   | 10  | 9   |    |     |     | 12 | 12   | 11  | 10  | 9   |    |    |     |



Figure 2-19S-1. 281140Z February 2003 MODIS true-color image of TC 19S (Japhet), located in the Mozambique Channel, with an intensity of 85 knots.

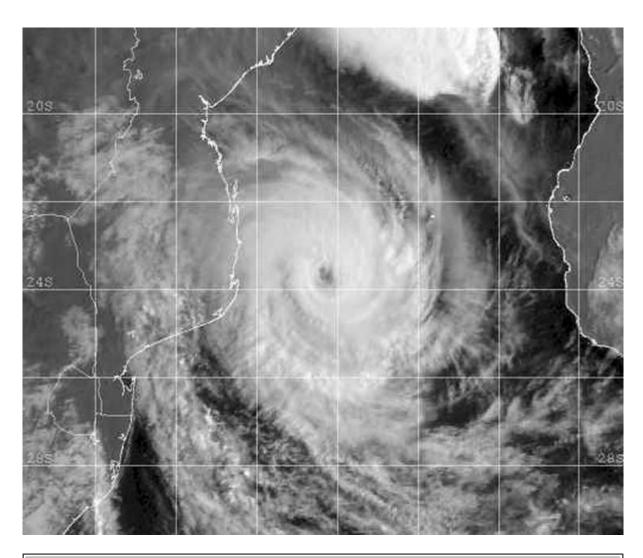


Figure 2-19S-2. 010600Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, with a maximum intensity of 115 knots.

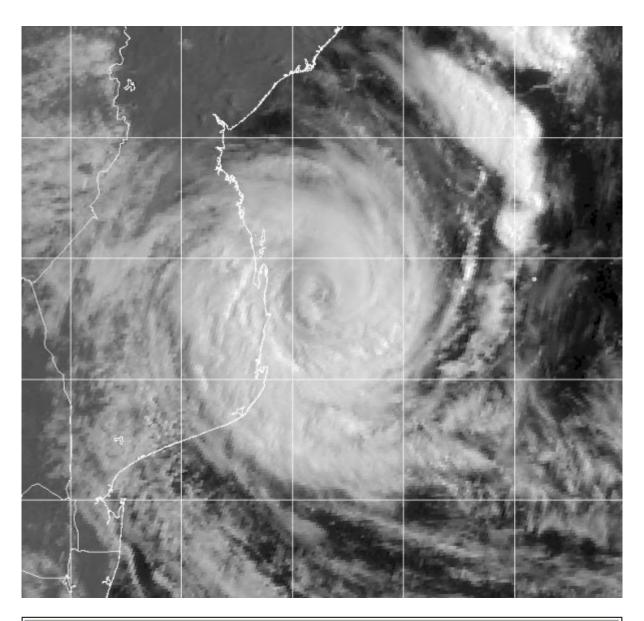
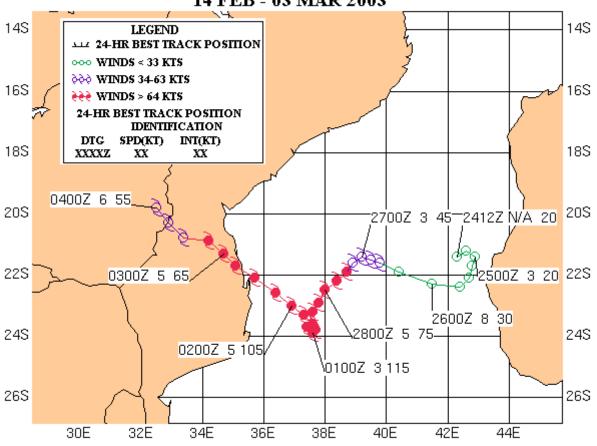
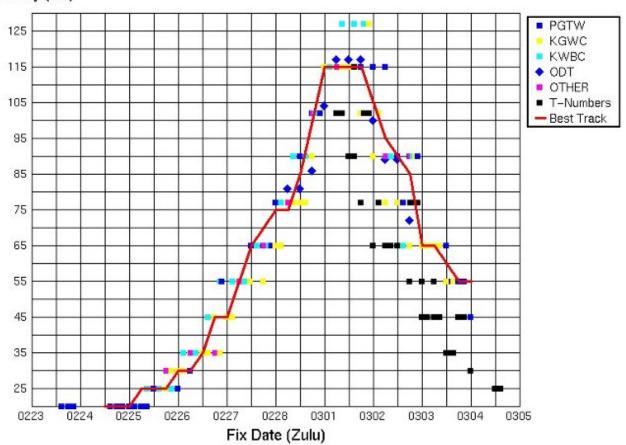


Figure 2-19S-3. 020630Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, just prior to landfall with an intensity of 95 knots.

#### TROPICAL CYCLONE 19S (JAPHET) 14 FEB - 03 MAR 2003



### Time Intensity for 19S



## Tropical Cyclone (TC) 20S (Graham)\*



First Poor: 1800Z 24 Feb 03 to 2300Z 26 Feb 03

First Fair: 0430Z 23 Feb 03 and 2300Z 26 Feb 03

First TCFA: 0230Z 27 Feb 03

First Warning: 1800Z 27 Feb 03

Last Warning: 0600Z 01 Mar 03, Dissipated

Max Intensity: 40 kts, gusts to 50 kts

Landfall: East of Mandora, Australia in the Eighty Mile Beach region

Total Warnings: 4

Remarks:

- (1) Tropical Cyclone (TC) 20S was first noted as an exposed low level circulation displaced from the convective activity about 210 nm east-northeast of Port Hedland, Australia around 24 February 2003. This weak exposed tropical cyclone remained quasi-stationary for approximately 48 hours. After that period, the synoptic scale patterns changed and allowed for vertical recoupling and cyclone movement toward the southeast. Due to the close proximity to land and movement into the Joseph Bonaparte Gulf, only 4 warnings were issued before the cyclone made landfall and was finaled.
- (2) No operational impacts and no damage was reported.

### Statistics for JTWC on TC20S

|          | WRN | BEST 1 | ΓRACK   |      | PO | SITIO | ON E | RRC | DRS | 3  |    |     | WII | ND | ERR | OR | S  |    |    |     |
|----------|-----|--------|---------|------|----|-------|------|-----|-----|----|----|-----|-----|----|-----|----|----|----|----|-----|
| DTG      | NO. | LAT    | LONG    | wind | 00 | 12    | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12 | 24  | 36 | 48 | 72 | 96 | 120 |
| 03022412 |     | 17.3S  | 118.5E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022418 |     | 17.1S  | 118.4E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022500 |     | 16.9S  | 118.4E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022506 |     | 16.7S  | 118.4E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022512 |     | 16.6S  | 118.6E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022518 |     | 16.8S  | 118.7E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022600 |     | 17.0S  | 118.8E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022606 |     | 17.2S  | 118.9E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022612 |     | 17.4S  | 119.0E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022618 |     | 17.6S  | 119.1E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022700 |     | 17.7S  | 119.4E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022706 |     | 17.7S  | 119.8E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022712 |     | 17.8S  | 120.2E  | 30   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022718 | 1   | 18.0S  | 120.5E  | 30   | 8  | 29    | 62   | 66  |     |    |    |     | 0   | 10 | -10 | -5 |    |    |    |     |
| 03022806 | 2   | 18.6S  | 120.7E  | 30   | 21 | 42    | 51   | 90  |     |    |    |     | 5   | 5  | 0   | 5  |    |    |    |     |
| 03022818 | 3   | 19.6S  | 121.1E  | 35   | 8  | 46    | 112  |     |     |    |    |     | 0   | 0  | 5   |    |    |    |    |     |
| 03030106 | 4   | 20.3S  | 121.7E  | 25   | 53 | 112   |      |     |     |    |    |     | 0   | 10 |     |    |    |    |    |     |
| 03030112 |     | 20.8S  | 122.0E  | 20   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03030118 |     | 21.5S  | 122.2E  | 15   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
|          |     |        | AVERAGE |      | 23 | 57    | 75   | 78  |     |    |    |     | 1   | 6  | 5   | 5  |    |    |    |     |
|          |     |        | BIAS    |      |    |       |      |     |     |    |    |     | 1   | 6  | -2  | 0  |    |    |    |     |
|          |     |        | # CASES |      | 4  | 4     | 3    | 2   |     |    |    |     | 4   | 4  | 3   | 2  |    |    |    |     |

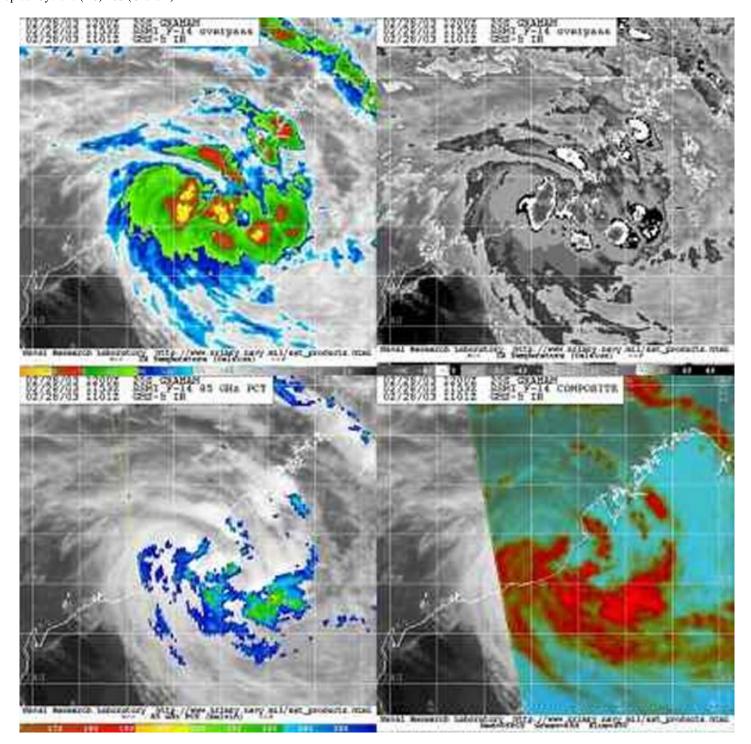
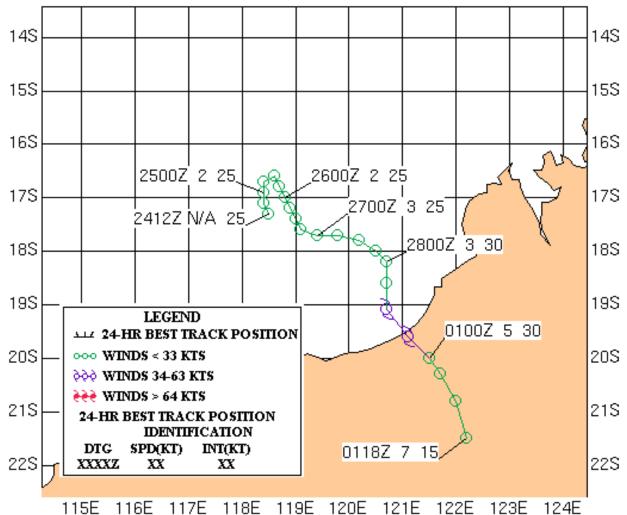
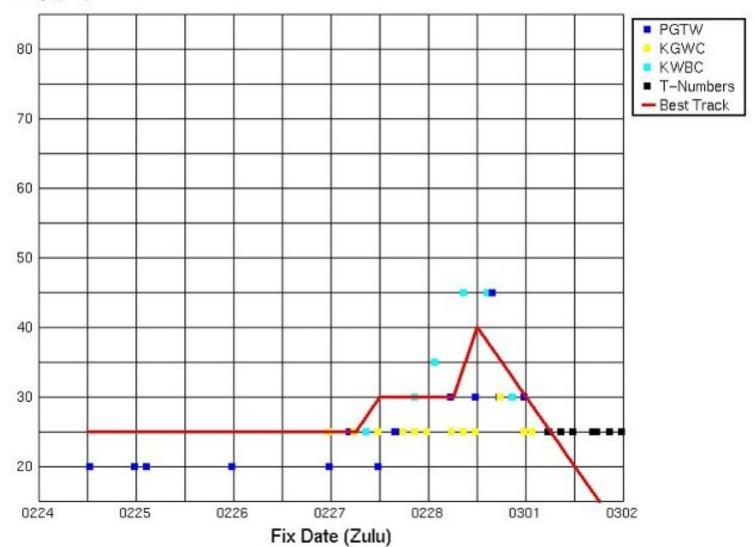


Figure 2-20S-1. 281153Z February 2003 multi-sensor satellite images of TC 20S (Graham), just off the northwest coast of Australia prior to landfall, with an intensity of 35 knots.





# Time Intensity for 20S



### Tropical Cyclone (TC) 20S (Graham)\*



First Poor: 1800Z 24 Feb 03 to 2300Z 26 Feb 03

First Fair: 0430Z 23 Feb 03 and 2300Z 26 Feb 03

First TCFA: 0230Z 27 Feb 03

First Warning: 1800Z 27 Feb 03

Last Warning: 0600Z 01 Mar 03, Dissipated

Max Intensity: 40 kts, gusts to 50 kts

Landfall: East of Mandora, Australia in the Eighty Mile Beach region

Total Warnings: 4

Remarks:

- (1) Tropical Cyclone (TC) 20S was first noted as an exposed low level circulation displaced from the convective activity about 210 nm east-northeast of Port Hedland, Australia around 24 February 2003. This weak exposed tropical cyclone remained quasi-stationary for approximately 48 hours. After that period, the synoptic scale patterns changed and allowed for vertical recoupling and cyclone movement toward the southeast. Due to the close proximity to land and movement into the Joseph Bonaparte Gulf, only 4 warnings were issued before the cyclone made landfall and was finaled.
- (2) No operational impacts and no damage was reported.

|          |     |        | S       | Statist | tics | for   | JTW  | Со  | n T | C2 | 0S |     |     |    |     |    |    |    |    |     |
|----------|-----|--------|---------|---------|------|-------|------|-----|-----|----|----|-----|-----|----|-----|----|----|----|----|-----|
|          |     |        |         |         |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
|          | WRN | BEST 1 | TRACK   |         | РО   | SITIC | ON E | RRC | DRS | 3  |    |     | WII | ND | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind    | 00   | 12    | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12 | 24  | 36 | 48 | 72 | 96 | 120 |
| 03022412 |     | 17.3S  | 118.5E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022418 |     | 17.1S  | 118.4E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022500 |     | 16.9S  | 118.4E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022506 |     | 16.7S  | 118.4E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022512 |     | 16.6S  | 118.6E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022518 |     | 16.8S  | 118.7E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022600 |     | 17.0S  | 118.8E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022606 |     | 17.2S  | 118.9E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022612 |     | 17.4S  | 119.0E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022618 |     | 17.6S  | 119.1E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022700 |     | 17.7S  | 119.4E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022706 |     | 17.7S  | 119.8E  | 25      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022712 |     | 17.8S  | 120.2E  | 30      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03022718 | 1   | 18.0S  | 120.5E  | 30      | 8    | 29    | 62   | 66  |     |    |    |     | 0   | 10 | -10 | -5 |    |    |    |     |
| 03022806 | 2   | 18.6S  | 120.7E  | 30      | 21   | 42    | 51   | 90  |     |    |    |     | 5   | 5  | 0   | 5  |    |    |    |     |
| 03022818 | 3   | 19.6S  | 121.1E  | 35      | 8    | 46    | 112  |     |     |    |    |     | 0   | 0  | 5   |    |    |    |    |     |
| 03030106 | 4   | 20.3S  | 121.7E  | 25      | 53   | 112   |      |     |     |    |    |     | 0   | 10 |     |    |    |    |    |     |
| 03030112 |     | 20.8S  | 122.0E  | 20      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03030118 |     | 21.5S  | 122.2E  | 15      |      |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
|          |     |        | AVERAGE |         | 23   | 57    | 75   | 78  |     |    |    |     | 1   | 6  | 5   | 5  |    |    |    |     |
|          |     |        | BIAS    |         |      |       |      |     |     |    |    |     | 1   | 6  | -2  | 0  |    |    |    |     |
|          |     |        | # CASES |         | 4    | 4     | 3    | 2   |     |    |    |     | 4   | 4  | 3   | 2  |    |    |    |     |

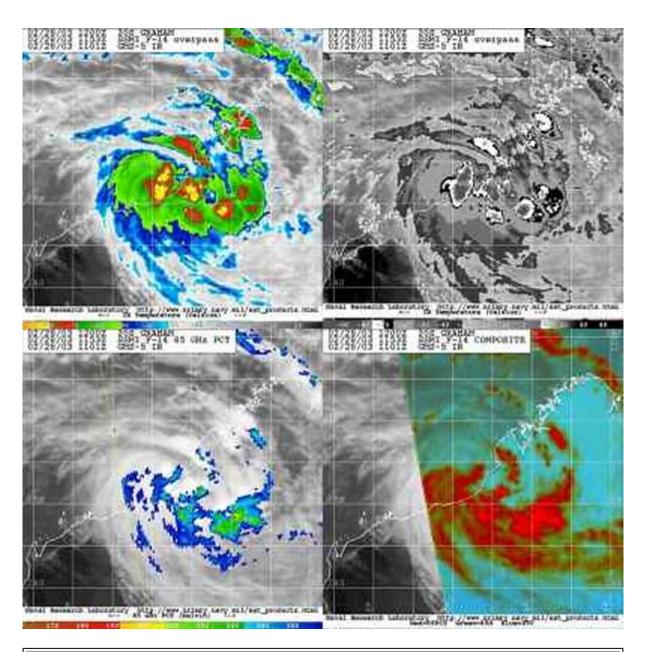
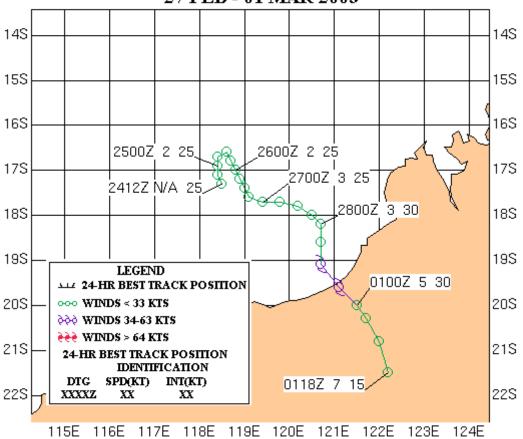


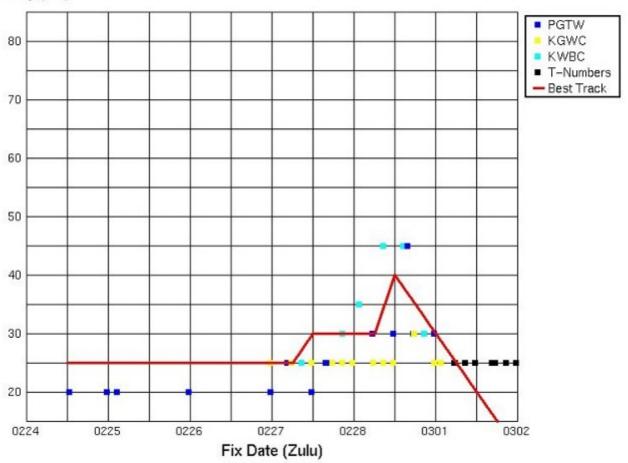
Figure 2-20S-1. 281153Z February 2003 multi-sensor satellite images of TC 20S (Graham), just off the northwest coast of Australia prior to landfall, with an intensity of 35 knots.

#### TROPICAL CYCLONE 20S (GRAHAM) 27 FEB - 01 MAR 2003



## Time Intensity for 20S





## **Tropical Cyclone (TC) 21S (Harriet)\***



First Poor: 0730Z 28 Feb 03

First Fair: 1800Z 01 Mar 03

First TCFA: 2100Z 01 Mar 03

First Warning: 0600Z 02 Mar 03

Last Warning: 0000Z 09 Mar 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 21

Remarks:

- (1) Tropical Cyclone (TC) 21S was first noted a a tropical disturbance on 28 February 2003. The cyclone tracked southwestward toward Australia, but development was hampered by dry air entrainment and moderate vertical wind shear. After crossing 110E, the cyclone slowed due to a developing sub-tropical ridge situated over western Australia. Subsequently and after 05 March, TC 21S adjusted to the steering environment and altered movement toward the southwest, well off the Australian coast and then dissipated approximately 295 nm west-northwest of Learmonth, Australia. Although JTWC issued 21 warnings on this tropical cyclone, it never intensified beyond 35 knots due to restrictive synoptic flow patterns.
- (2) No damage was reported for this system.

| <b>Statistics</b> | for l' | TWC | on T | 2218           |
|-------------------|--------|-----|------|----------------|
| ่อเลเเธเเเธ       | IUI J  |     |      | <i>7</i> 4   0 |

|          | WRN | BEST T | TRACK   |      | PO | SIT | ION | ERR | ORS |     |    |     | WII | ND | ERF | ROF | RS |    |    |     |
|----------|-----|--------|---------|------|----|-----|-----|-----|-----|-----|----|-----|-----|----|-----|-----|----|----|----|-----|
| DTG      | NO. | LAT    | LONG    | wind | 00 | 12  | 24  | 36  | 48  | 72  | 96 | 120 | 00  | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03030106 |     | 12.8S  | 102.8E  | 20   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
| 03030112 |     | 13.1S  | 103.6E  | 20   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
| 03030118 |     | 13.4S  | 104.7E  | 25   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
| 03030200 |     | 13.8S  | 105.9E  | 25   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
| 03030206 | 1   | 14.1S  | 106.7E  | 30   | 0  | 13  | 32  | 67  | 105 |     |    |     | 5   | 15 | 20  | 25  | 25 |    |    |     |
| 03030218 | 2   | 14.8S  | 108.4E  | 30   | 8  | 40  | 64  | 61  | 53  |     |    |     | 5   | 5  | 10  | 15  | 10 |    |    |     |
| 03030306 | 3   | 14.7S  | 110.1E  | 30   | 5  | 13  | 26  | 6   | 48  |     |    |     | 5   | 10 | 10  | 10  | 10 |    |    |     |
| 03030318 | 4   | 14.7S  | 111.5E  | 30   | 0  | 17  | 6   | 27  | 47  |     |    |     | 5   | 5  | 5   | 5   | 15 |    |    |     |
| 03030406 | 5   | 14.9S  | 112.5E  | 30   | 18 | 65  | 94  | 156 | 185 |     |    |     | 5   | 5  | 10  | 15  | 15 |    |    |     |
| 03030418 | 6   | 15.2S  | 114.1E  | 35   | 23 | 59  | 75  | 43  | 36  | 74  |    |     | 0   | 5  | 10  | 10  | 15 | 25 |    |     |
| 03030500 | 7   | 15.8S  | 114.8E  | 35   | 29 |     |     |     |     |     |    |     | 0   |    |     |     |    |    |    |     |
| 03030506 | 8   | 16.3S  | 115.3E  | 35   | 13 | 46  | 48  | 13  | 72  | 117 |    |     | 0   | 5  | 5   | 10  | 15 | 20 |    |     |
| 03030512 | 9   | 16.8S  | 115.7E  | 30   | 20 | 27  | 25  | 33  | 73  | 134 |    |     | 0   | -5 | 0   | 5   | 5  | 10 |    |     |
| 03030518 | 10  | 17.4S  | 116.2E  | 30   | 18 | 54  | 65  | 80  | 106 | 169 |    |     | 0   | 0  | 0   | 5   | 15 | 20 |    |     |
| 03030600 | 11  | 18.1S  | 115.8E  | 35   | 11 | 28  | 53  | 79  | 123 | 145 |    |     | 0   | 0  | 5   | 10  | 20 | 30 |    |     |
| 03030606 | 12  | 18.6S  | 115.5E  | 35   | 46 | 74  | 129 | 166 | 210 | 190 |    |     | 0   | 0  | 5   | 15  | 15 | 25 |    |     |
| 03030612 | 13  | 19.0S  | 115.2E  | 35   | 51 | 91  | 128 | 170 | 202 | 110 |    |     | 0   | 0  | 0   | 10  | 10 | 20 |    |     |
| 03030618 | 14  | 19.1S  | 114.8E  | 35   | 16 | 57  | 98  | 125 | 167 |     |    |     | 0   | 0  | 10  | 10  | 15 |    |    |     |
| 03030700 | 15  | 19.0S  | 114.5E  | 35   | 12 | 13  | 45  | 79  | 93  |     |    |     | 0   | 0  | 10  | 10  | 20 |    |    |     |
| 03030706 | 16  | 19.0S  | 114.2E  | 35   | 13 | 13  | 33  | 57  | 71  |     |    |     | 0   | 5  | 10  | 15  | 15 |    |    |     |
| 03030712 | 17  | 19.3S  | 113.8E  | 35   | 5  | 47  | 90  | 94  | 47  |     |    |     | 0   | 5  | 10  | 15  | 10 |    |    |     |
| 03030718 | 18  | 19.4S  | 113.4E  | 30   | 12 | 31  | 66  | 66  |     |     |    |     | 0   | 0  | 0   | 5   |    |    |    |     |
| 03030800 | 19  | 19.6S  | 113.0E  | 30   | 8  | 38  | 60  |     |     |     |    |     | 0   | 0  | 0   |     |    |    |    |     |
| 03030812 | 20  | 20.2S  | 112.4E  | 30   | 0  | 26  | 74  |     |     |     |    |     | 0   | 5  | 0   |     |    |    |    |     |
| 03030900 | 21  | 21.1S  | 110.8E  | 25   | 28 | 96  |     |     |     |     |    |     | 0   | 0  |     |     |    |    |    |     |
| 03030906 |     | 22.2S  | 109.5E  | 25   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
| 03030912 |     | 23.7S  | 108.5E  | 25   |    |     |     |     |     |     |    |     |     |    |     |     |    |    |    |     |
|          |     |        | AVERAGE |      | 16 | 42  | 64  | 78  | 102 | 134 |    |     | 1   | 4  | 6   | 11  | 14 | 21 |    |     |
|          |     |        | BIAS    |      |    |     |     |     |     |     |    |     | 1   | 3  | 6   | 11  | 14 | 21 |    |     |
|          |     |        | # CASES |      | 21 | 20  | 19  | 17  | 16  | 7   |    |     | 21  | 20 | 19  | 17  | 16 | 7  |    |     |

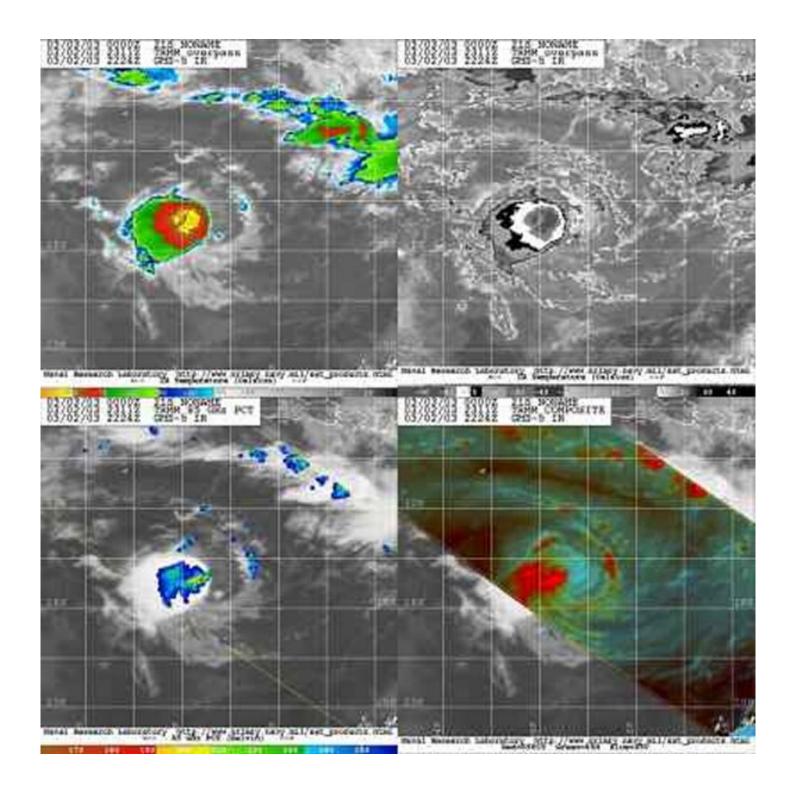


Figure 2-21S-1. 022311Z March 2003 multi-sensor satellite images of TC 21S (Harriet), 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.

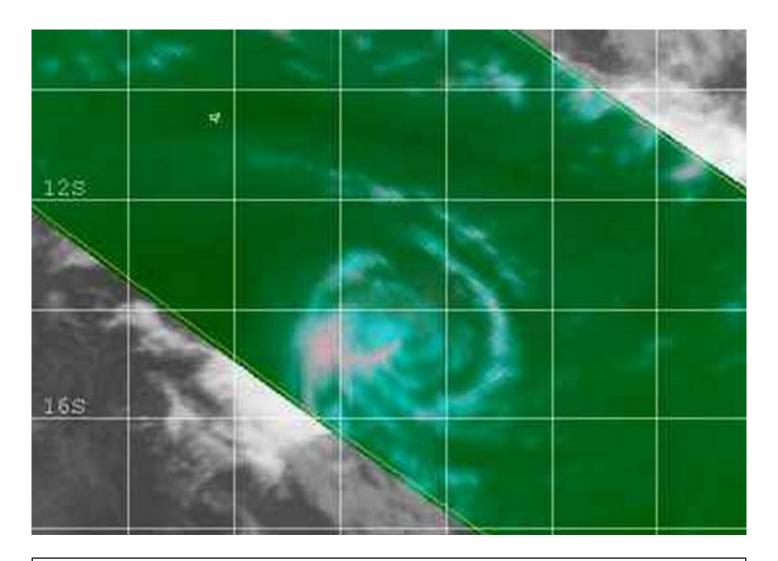
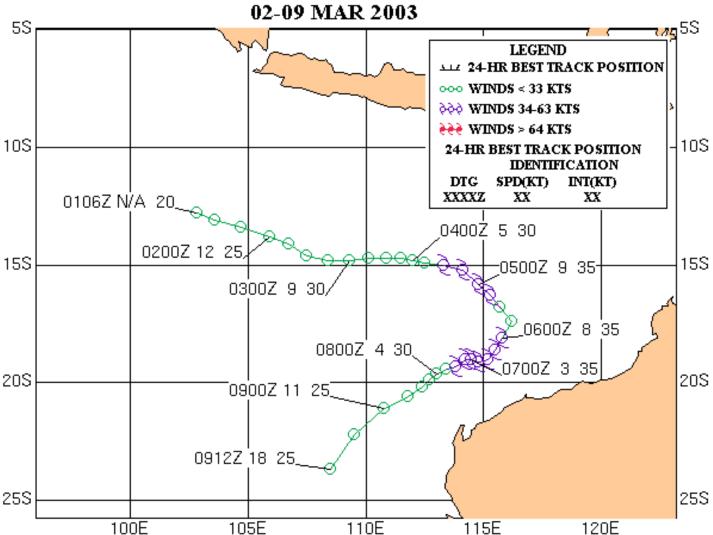
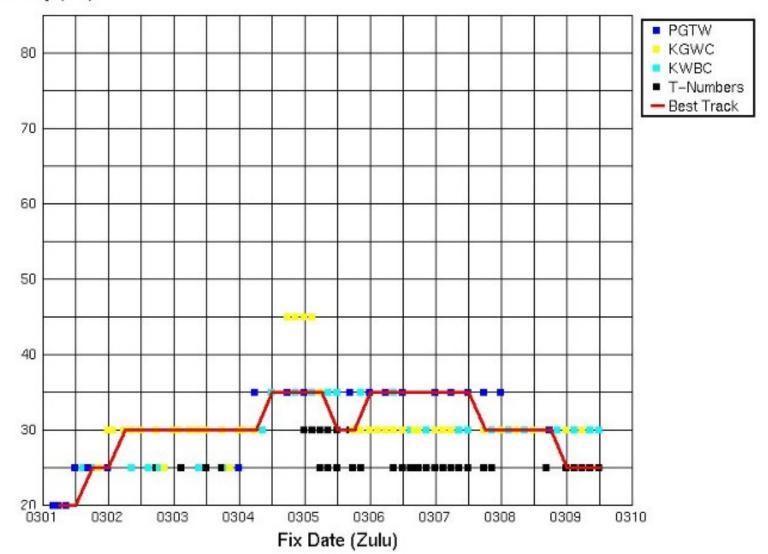


Figure 2-21S-2. 022311Z March 2003 37GHz TRMM imagery of TC 21S (Harriet), The exposed low level circulation center is 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.





# Time Intensity for 21S



### **Tropical Cyclone (TC) 21S (Harriet)\***



First Poor: 0730Z 28 Feb 03

First Fair: 1800Z 01 Mar 03

First TCFA: 2100Z 01 Mar 03

First Warning: 0600Z 02 Mar 03

Last Warning: 0000Z 09 Mar 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: None

Total Warnings: 21

Remarks:

- (1) Tropical Cyclone (TC) 21S was first noted a a tropical disturbance on 28 February 2003. The cyclone tracked southwestward toward Australia, but development was hampered by dry air entrainment and moderate vertical wind shear. After crossing 110E, the cyclone slowed due to a developing sub-tropical ridge situated over western Australia. Subsequently and after 05 March, TC 21S adjusted to the steering environment and altered movement toward the southwest, well off the Australian coast and then dissipated approximately 295 nm west-northwest of Learmonth, Australia. Although JTWC issued 21 warnings on this tropical cyclone, it never intensified beyond 35 knots due to restrictive synoptic flow patterns.
- (2) No damage was reported for this system.

|          |     |        | ;       | Statis            | tic | s fo | r JT | WC  | on T | C21 | S  |     |    |    |     |     |    |    |    |     |
|----------|-----|--------|---------|-------------------|-----|------|------|-----|------|-----|----|-----|----|----|-----|-----|----|----|----|-----|
|          |     |        |         | POSITION ERRORS W |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
|          | WRN | BEST T | ΓRACK   |                   | РО  | SIT  | ION  | ERR | ORS  |     |    |     | WI | ND | ERF | ROF | RS |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind              | 00  | 12   | 24   | 36  | 48   | 72  | 96 | 120 | 00 | 12 | 24  | 36  | 48 | 72 | 96 | 120 |
| 03030106 |     | 12.8S  | 102.8E  | 20                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
| 03030112 |     | 13.1S  | 103.6E  | 20                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
| 03030118 |     | 13.4S  | 104.7E  | 25                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
| 03030200 |     | 13.8S  | 105.9E  | 25                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
| 03030206 | 1   | 14.1S  | 106.7E  | 30                | 0   | 13   | 32   | 67  | 105  |     |    |     | 5  | 15 | 20  | 25  | 25 |    |    |     |
| 03030218 | 2   | 14.8S  | 108.4E  | 30                | 8   | 40   | 64   | 61  | 53   |     |    |     | 5  | 5  | 10  | 15  | 10 |    |    |     |
| 03030306 | 3   | 14.7S  | 110.1E  | 30                | 5   | 13   | 26   | 6   | 48   |     |    |     | 5  | 10 | 10  | 10  | 10 |    |    |     |
| 03030318 | 4   | 14.7S  | 111.5E  | 30                | 0   | 17   | 6    | 27  | 47   |     |    |     | 5  | 5  | 5   | 5   | 15 |    |    |     |
| 03030406 | 5   | 14.9S  | 112.5E  | 30                | 18  | 65   | 94   | 156 | 185  |     |    |     | 5  | 5  | 10  | 15  | 15 |    |    |     |
| 03030418 | 6   | 15.2S  | 114.1E  | 35                | 23  | 59   | 75   | 43  | 36   | 74  |    |     | 0  | 5  | 10  | 10  | 15 | 25 |    |     |
| 03030500 | 7   | 15.8S  | 114.8E  | 35                | 29  |      |      |     |      |     |    |     | 0  |    |     |     |    |    |    |     |
| 03030506 | 8   | 16.3S  | 115.3E  | 35                | 13  | 46   | 48   | 13  | 72   | 117 |    |     | 0  | 5  | 5   | 10  | 15 | 20 |    |     |
| 03030512 | 9   | 16.8S  | 115.7E  | 30                | 20  | 27   | 25   | 33  | 73   | 134 |    |     | 0  | -5 | 0   | 5   | 5  | 10 |    |     |
| 03030518 | 10  | 17.4S  | 116.2E  | 30                | 18  | 54   | 65   | 80  | 106  | 169 |    |     | 0  | 0  | 0   | 5   | 15 | 20 |    |     |
| 03030600 | 11  | 18.1S  | 115.8E  | 35                | 11  | 28   | 53   | 79  | 123  | 145 |    |     | 0  | 0  | 5   | 10  | 20 | 30 |    |     |
| 03030606 | 12  | 18.6S  | 115.5E  | 35                | 46  | 74   | 129  | 166 | 210  | 190 |    |     | 0  | 0  | 5   | 15  | 15 | 25 |    |     |
| 03030612 | 13  | 19.0S  | 115.2E  | 35                | 51  | 91   | 128  | 170 | 202  | 110 |    |     | 0  | 0  | 0   | 10  | 10 | 20 |    |     |
| 03030618 | 14  | 19.1S  | 114.8E  | 35                | 16  | 57   | 98   | 125 | 167  |     |    |     | 0  | 0  | 10  | 10  | 15 |    |    |     |
| 03030700 | 15  | 19.0S  | 114.5E  | 35                | 12  | 13   | 45   | 79  | 93   |     |    |     | 0  | 0  | 10  | 10  | 20 |    |    |     |
| 03030706 | 16  | 19.0S  | 114.2E  | 35                | 13  | 13   | 33   | 57  | 71   |     |    |     | 0  | 5  | 10  | 15  | 15 |    |    |     |
| 03030712 | 17  | 19.3S  | 113.8E  | 35                | 5   | 47   | 90   | 94  | 47   |     |    |     | 0  | 5  | 10  | 15  | 10 |    |    |     |
| 03030718 | 18  | 19.4S  | 113.4E  | 30                | 12  | 31   | 66   | 66  |      |     |    |     | 0  | 0  | 0   | 5   |    |    |    |     |
| 03030800 | 19  | 19.6S  | 113.0E  | 30                | 8   | 38   | 60   |     |      |     |    |     | 0  | 0  | 0   |     |    |    |    |     |
| 03030812 | 20  | 20.2S  | 112.4E  | 30                | 0   | 26   | 74   |     |      |     |    |     | 0  | 5  | 0   |     |    |    |    |     |
| 03030900 | 21  | 21.1S  | 110.8E  | 25                | 28  | 96   |      |     |      |     |    |     | 0  | 0  |     |     |    |    |    |     |
| 03030906 |     | 22.2S  | 109.5E  | 25                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
| 03030912 |     | 23.7S  | 108.5E  | 25                |     |      |      |     |      |     |    |     |    |    |     |     |    |    |    |     |
|          |     |        | AVERAGE |                   | 16  | 42   | 64   | 78  | 102  | 134 |    |     | 1  | 4  | 6   | 11  | 14 | 21 |    |     |
|          |     |        | BIAS    |                   |     |      |      |     |      |     |    |     | 1  | 3  | 6   | 11  | 14 | 21 |    |     |
|          |     |        | # CASES |                   | 21  | 20   | 19   | 17  | 16   | 7   |    |     | 21 | 20 | 19  | 17  | 16 | 7  |    |     |

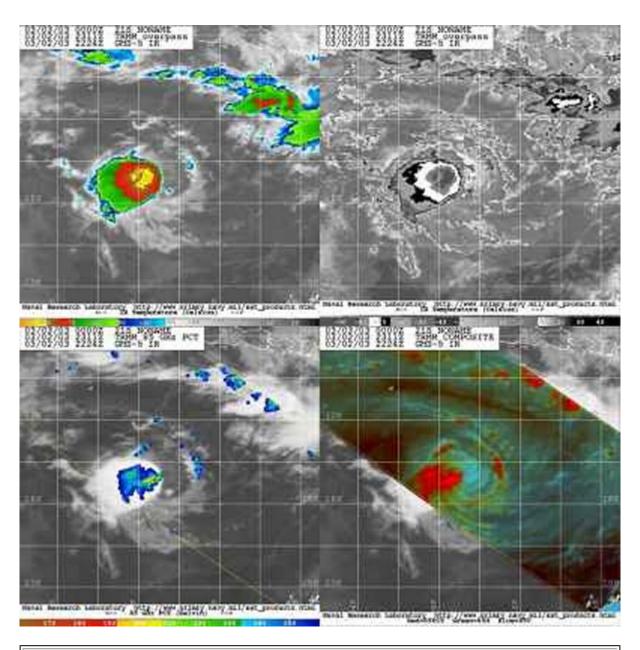


Figure 2-21S-1. 022311Z March 2003 multi-sensor satellite images of TC 21S (Harriet), 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.

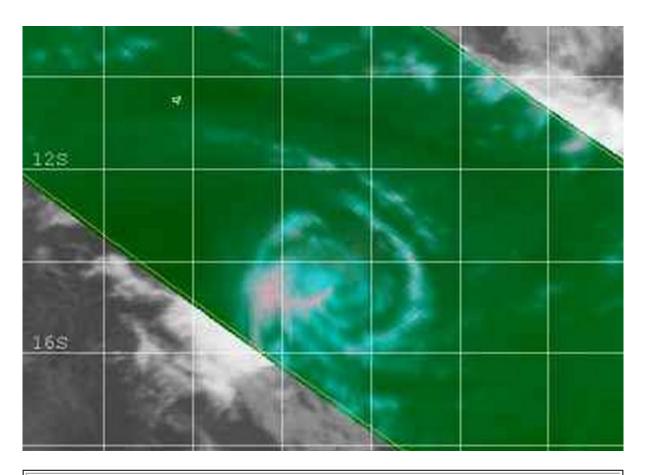
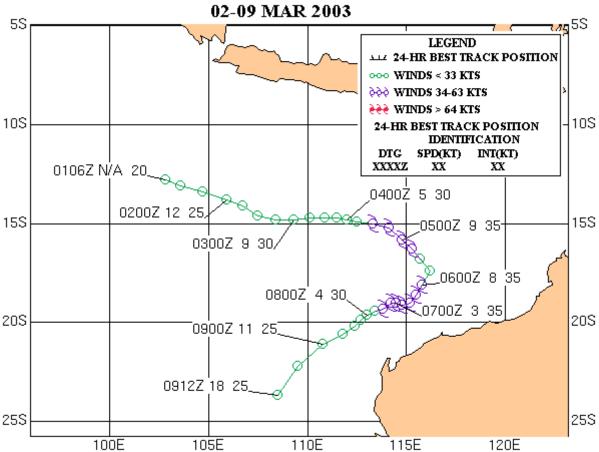
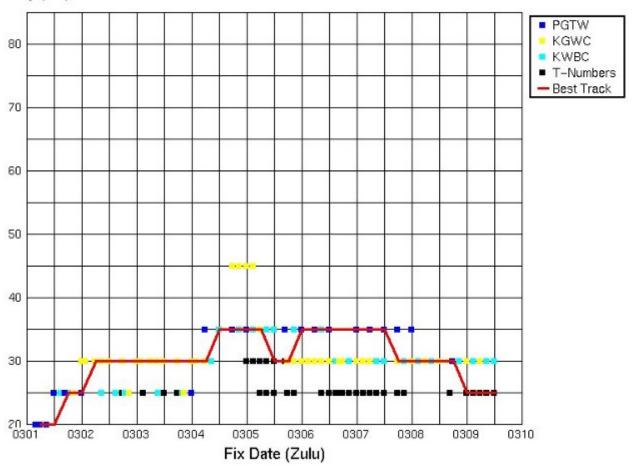


Figure 2-21S-2. 022311Z March 2003 37GHz TRMM imagery of TC 21S (Harriet), The exposed low level circulation center is 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.

## TROPICAL CYCLONE 21S (HARRIET)



## Time Intensity for 21S



## Tropical Cyclone (TC) 22P (Erica)\*



First Poor : 2330Z 03 Mar 03

First Fair: 0600Z 04 Mar 03

First TCFA: 0630Z 04 Mar 03

First Warning: 1200Z 04 Mar 03

Last Warning: 0600Z 15 Mar 03, Extratropical

Max Intensity: 130 kts, gusts to 160 kts

Landfall: None

Total Warnings: 16 plus 2 Amended Warnings

Remarks:

(1) Tropical Cyclone (TC) 22P was first noted as a tropical disturbance east-southeast of Cairns, Australia on 03 March, 2003. TC 22P formed and went to warning status within 14 hours of first official mention by JTWC. The cyclone weakened enough to final at 0000Z on 06 March. JTWC continued to monitor the remnants of TC 22P and when regeneration was detected the cyclone was warned on again by 10 March.

Over the next 48 hours the storm intensified at a climatological rate, attaining a 65 knot intensity, a rate of one Dvorak T-number per day. TC 22P then began to intensify rapidly, reaching the maximum intensity of 130 knots by 13 March, an increase of 2.5 Dvorak T-numbers in 18 hours. The rapid intensification was due to excellent outflow conditions combined with a weak vertical wind shear environment. During this period, TC 22P altered track toward New Caledonia, eventually skirting the entire southwestern coast of New Caledonia with an intensity of 130, 125 and 100 knots throughout. After passing New Caledonia, the cyclone encountered increased vertical wind shear and began extratropical transition.

(2) Reported damage to New Caledonia was significant, and included structural damage, power losses and flooding. Noumea was also damaged by the passage of the system according to news reports. Subsequent damage reports from New Caledonia indicated agricultural damage, water fouling and an increase in dengue fever. Two fatalities were also reported due to the passage of

the system, with many others injured.

|          |     |       |         | Stat | isti | cs fo | or JT | ΓWC | on ' | TC | 22P |     |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|------|------|-------|-------|-----|------|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |      |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |      | РО   | SITI  | ON E  | RRC | RS   |    |     |     | WIN | ID E | RRC | DRS |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind | 00   | 12    | 24    | 36  | 48   | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03030400 |     | 20.1S | 152.4E  | 20   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03030406 |     | 20.8S | 153.1E  | 25   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03030412 | 1   | 21.3S | 154.0E  | 30   | 18   | 103   | 130   | 155 | 187  |    |     |     | 5   | 5    | 5   | 10  | 5   |    |    |     |
| 03030500 | 2   | 20.3S | 155.0E  | 30   | 51   | 108   | 135   | 187 | 277  |    |     |     | 0   | -5   | 5   | 0   | 0   |    |    |     |
| 03030512 | 3   | 19.0S | 155.3E  | 35   | 16   | 21    | 24    | 93  | 146  |    |     |     | 0   | 5    | 5   | 5   | 5   |    |    |     |
| 03030600 | 4   | 17.6S | 154.4E  | 30   | 11   | 42    |       |     |      |    |     |     | 0   | 0    |     |     |     |    |    |     |
| 03031006 | 5   | 12.1S | 157.8E  | 30   | 6    | 24    | 30    | 83  | 152  |    |     |     | 0   | 0    | -5  | -10 | -15 |    |    |     |
| 03031018 | 6   | 12.7S | 158.2E  | 35   | 16   | 19    | 87    | 155 | 179  |    |     |     | 0   | -5   | -10 | -15 | -60 |    |    |     |
| 03031106 | 7   | 13.4S | 158.9E  | 45   | 13   | 55    | 98    | 138 | 167  |    |     |     | 0   | -5   | -10 | -55 | -65 |    |    |     |
| 03031118 | 8   | 15.2S | 159.6E  | 55   | 0    | 33    | 64    | 103 | 130  |    |     |     | 0   | -5   | -45 | -60 | -60 |    |    |     |
| 03031206 | 9   | 17.1S | 159.9E  | 65   | 16   | 67    | 113   | 140 | 317  |    |     |     | 0   | -45  | -65 | -60 | -30 |    |    |     |
| 03031212 | 10  | 17.9S | 160.4E  | 90   | 0    | 66    | 96    | 176 | 364  |    |     |     | 5   | -35  | -35 | -10 | 5   |    |    |     |
| 03031218 | 11  | 18.8S | 160.8E  | 115  | 18   | 32    | 87    | 227 | 377  |    |     |     | -15 | -35  | -35 | -10 | 0   |    |    |     |
| 03031300 | 11A | 19.6S | 161.3E  | 130  | 22   | 32    | 120   | 287 | 421  |    |     |     | -5  | 5    | 25  | 30  | 35  |    |    |     |
| 03031306 | 12  | 20.2S | 162.0E  | 130  | 0    | 41    | 173   | 273 | 370  |    |     |     | 10  | 25   | 40  | 45  | 70  |    |    |     |
| 03031318 | 13  | 21.1S | 164.2E  | 125  | 12   | 118   | 188   | 278 |      |    |     |     | -25 | -5   | 0   | 25  |     |    |    |     |
| 03031406 | 14  | 23.1S | 168.7E  | 90   | 8    | 56    | 150   |     |      |    |     |     | -10 | 0    | 30  |     |     |    |    |     |
| 03031418 | 15  | 25.9S | 173.5E  | 70   | 17   | 98    |       |     |      |    |     |     | 0   | 35   |     |     |     |    |    |     |
| 03031506 | 16  | 28.8S | 179.0E  | 30   | 19   |       |       |     |      |    |     |     | 15  |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |      | 15   | 57    | 107   | 177 | 257  |    |     |     | 5   | 13   | 23  | 26  | 29  |    |    |     |
|          |     |       | BIAS    |      |      |       |       |     |      |    |     |     | -1  | -4   | -7  | -8  | -9  |    |    |     |
|          |     |       | # CASES |      | 17   | 16    | 14    | 13  | 12   |    |     |     | 17  | 16   | 14  | 13  | 12  |    |    |     |

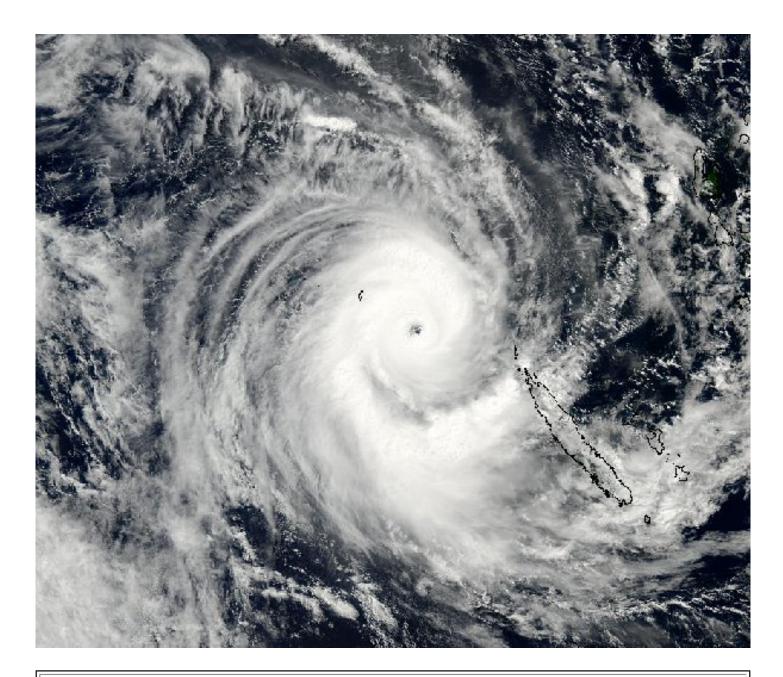


Figure 2-22P-1. 130255Z March 2003 MODIS true-color image of TC 22P (Erica), located 165nm west-northwest of New Caledonia, with a maximum intensity of 130 knots.

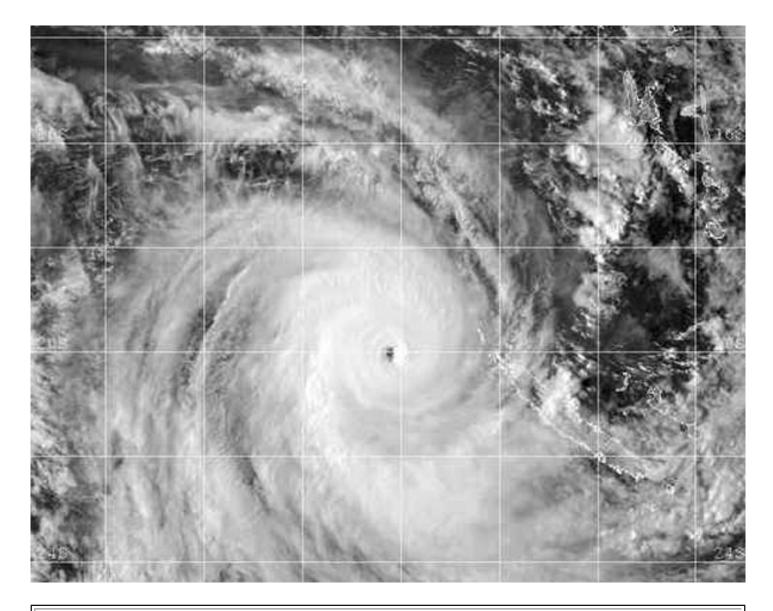


Figure 2-22P-2. 130501Z March 2003 GMS-5 visible satellite imagery of TC 22P (Erica), 945 nm east of Cairns, Australia, with an increasing intensity of 125 knots.

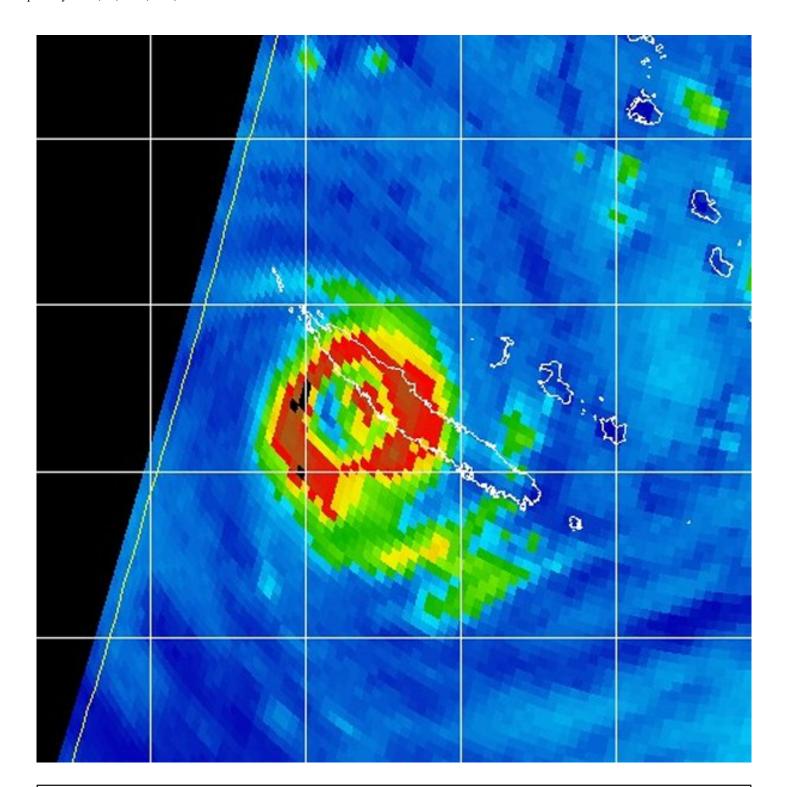
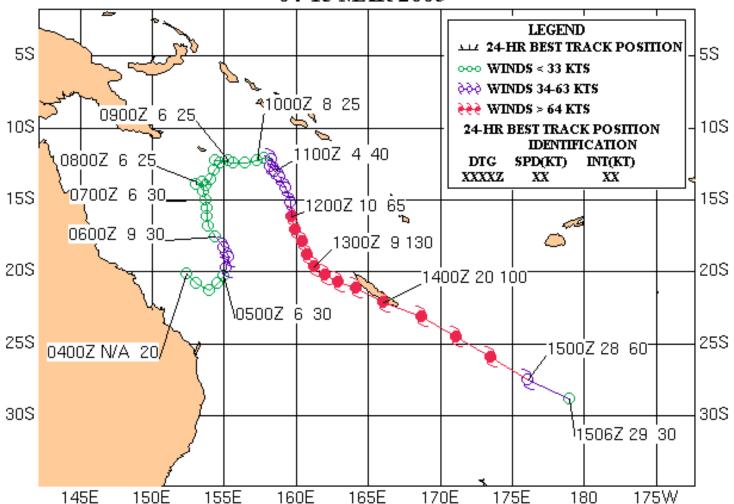
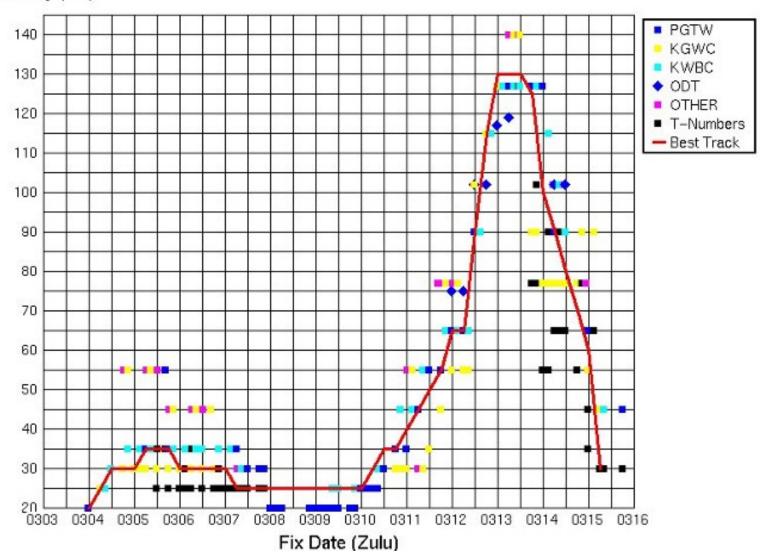


Figure 2-22P-3. 131850Z March 2003 85 GHz SSM/I imagery of TC 22P (Erica), 905 nm east of Cairns, Australia, with an increasing intensity of 100 knots.

### TROPICAL CYCLONE 22P (ERICA) 04-15 MAR 2003



## Time Intensity for 22P



## Tropical Cyclone (TC) 22P (Erica)\*



First Poor: 2330Z 03 Mar 03

First Fair: 0600Z 04 Mar 03

First TCFA: 0630Z 04 Mar 03

First Warning: 1200Z 04 Mar 03

Last Warning: 0600Z 15 Mar 03, Extratropical

Max Intensity: 130 kts, gusts to 160 kts

Landfall: None

Total Warnings: 16 plus 2 Amended Warnings

Remarks:

(1) Tropical Cyclone (TC) 22P was first noted as a tropical disturbance east-southeast of Cairns, Australia on 03 March, 2003. TC 22P formed and went to warning status within 14 hours of first official mention by JTWC. The cyclone weakened enough to final at 0000Z on 06 March. JTWC continued to monitor the remnants of TC 22P and when regeneration was detected the cyclone was warned on again by 10 March.

Over the next 48 hours the storm intensified at a climatological rate, attaining a 65 knot intensity, a rate of one Dvorak T-number per day. TC 22P then began to intensify rapidly, reaching the maximum intensity of 130 knots by 13 March, an increase of 2.5 Dvorak T-numbers in 18 hours. The rapid intensification was due to excellent outflow conditions combined with a weak vertical wind shear environment. During this period, TC 22P altered track toward New Caledonia, eventually skirting the entire southwestern coast of New Caledonia with an intensity of 130, 125 and 100 knots throughout. After passing New Caledonia, the cyclone encountered increased vertical wind shear and began extratropical transition.

(2) Reported damage to New Caledonia was significant, and included structural damage, power losses and flooding. Noumea was also damaged by the passage of the system according to news reports. Subsequent damage reports from New Caledonia indicated agricultural damage, water fouling and an increase in dengue fever. Two fatalities were also reported due to the passage of the system, with many others injured.

|          |     |       |         | Stat | isti | cs fo | or JT | ΓWC | on ' | TC | 22P | ,   |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|------|------|-------|-------|-----|------|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |      |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |      | PO   | SITIO | ON E  | RRC | RS   | ,  |     |     | WIN | ND E | RRC | DRS | ,   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind | 00   | 12    | 24    | 36  | 48   | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03030400 |     | 20.1S | 152.4E  | 20   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03030406 |     | 20.8S | 153.1E  | 25   |      |       |       |     |      |    |     |     |     |      |     |     |     |    |    |     |
| 03030412 | 1   | 21.3S | 154.0E  | 30   | 18   | 103   | 130   | 155 | 187  |    |     |     | 5   | 5    | 5   | 10  | 5   |    |    |     |
| 03030500 | 2   | 20.3S | 155.0E  | 30   | 51   | 108   | 135   | 187 | 277  |    |     |     | 0   | -5   | 5   | 0   | 0   |    |    |     |
| 03030512 | 3   | 19.0S | 155.3E  | 35   | 16   | 21    | 24    | 93  | 146  |    |     |     | 0   | 5    | 5   | 5   | 5   |    |    |     |
| 03030600 | 4   | 17.6S | 154.4E  | 30   | 11   | 42    |       |     |      |    |     |     | 0   | 0    |     |     |     |    |    |     |
| 03031006 | 5   | 12.1S | 157.8E  | 30   | 6    | 24    | 30    | 83  | 152  |    |     |     | 0   | 0    | -5  | -10 | -15 |    |    |     |
| 03031018 | 6   | 12.7S | 158.2E  | 35   | 16   | 19    | 87    | 155 | 179  |    |     |     | 0   | -5   | -10 | -15 | -60 |    |    |     |
| 03031106 | 7   | 13.4S | 158.9E  | 45   | 13   | 55    | 98    | 138 | 167  |    |     |     | 0   | -5   | -10 | -55 | -65 |    |    |     |
| 03031118 | 8   | 15.2S | 159.6E  | 55   | 0    | 33    | 64    | 103 | 130  |    |     |     | 0   | -5   | -45 | -60 | -60 |    |    |     |
| 03031206 | 9   | 17.1S | 159.9E  | 65   | 16   | 67    | 113   | 140 | 317  |    |     |     | 0   | -45  | -65 | -60 | -30 |    |    |     |
| 03031212 | 10  | 17.9S | 160.4E  | 90   | 0    | 66    | 96    | 176 | 364  |    |     |     | 5   | -35  | -35 | -10 | 5   |    |    |     |
| 03031218 | 11  | 18.8S | 160.8E  | 115  | 18   | 32    | 87    | 227 | 377  |    |     |     | -15 | -35  | -35 | -10 | 0   |    |    |     |
| 03031300 | 11A | 19.6S | 161.3E  | 130  | 22   | 32    | 120   | 287 | 421  |    |     |     | -5  | 5    | 25  | 30  | 35  |    |    |     |
| 03031306 | 12  | 20.2S | 162.0E  | 130  | 0    | 41    | 173   | 273 | 370  |    |     |     | 10  | 25   | 40  | 45  | 70  |    |    |     |
| 03031318 | 13  | 21.1S | 164.2E  | 125  | 12   | 118   | 188   | 278 |      |    |     |     | -25 | -5   | 0   | 25  |     |    |    |     |
| 03031406 | 14  | 23.1S | 168.7E  | 90   | 8    | 56    | 150   |     |      |    |     |     | -10 | 0    | 30  |     |     |    |    |     |
| 03031418 | 15  | 25.9S | 173.5E  | 70   | 17   | 98    |       |     |      |    |     |     | 0   | 35   |     |     |     |    |    |     |
| 03031506 | 16  | 28.8S | 179.0E  | 30   | 19   |       |       |     |      |    |     |     | 15  |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |      | 15   | 57    | 107   | 177 | 257  |    |     |     | 5   | 13   | 23  | 26  | 29  |    |    |     |
|          |     |       | BIAS    |      |      |       |       |     |      |    |     |     | -1  | -4   | -7  | -8  | -9  |    |    |     |
|          |     |       | # CASES |      | 17   | 16    | 14    | 13  | 12   |    |     |     | 17  | 16   | 14  | 13  | 12  |    |    |     |

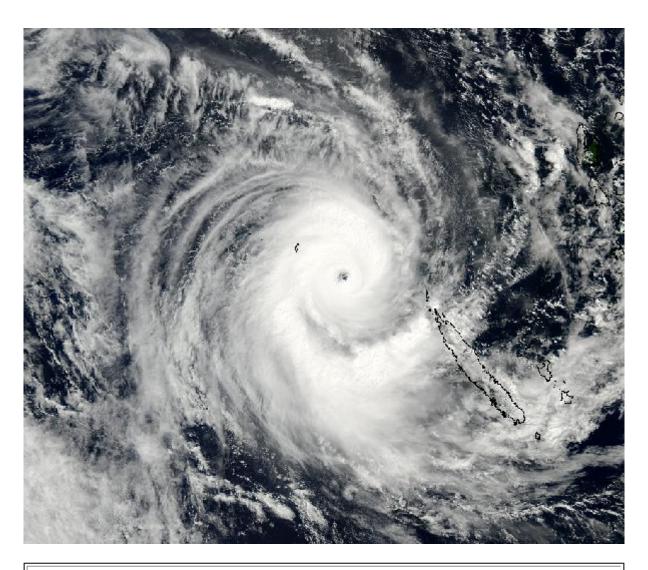


Figure 2-22P-1. 130255Z March 2003 MODIS true-color image of TC 22P (Erica), located 165nm west-northwest of New Caledonia, with a maximum intensity of 130 knots.

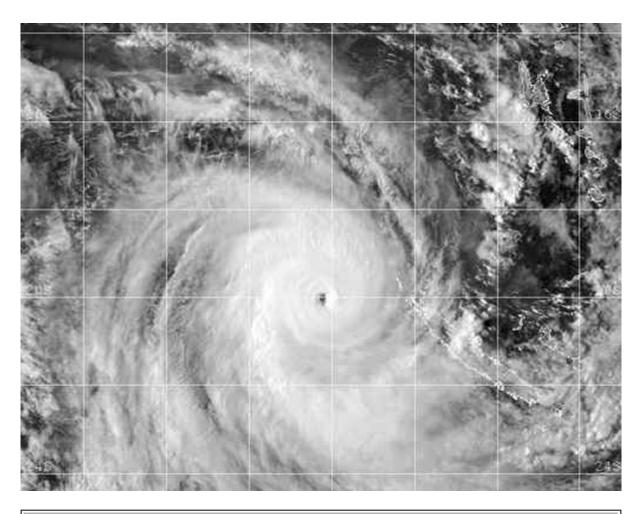


Figure 2-22P-2. 130501Z March 2003 GMS-5 visible satellite imagery of TC 22P (Erica), 945 nm east of Cairns, Australia, with an increasing intensity of 125 knots.

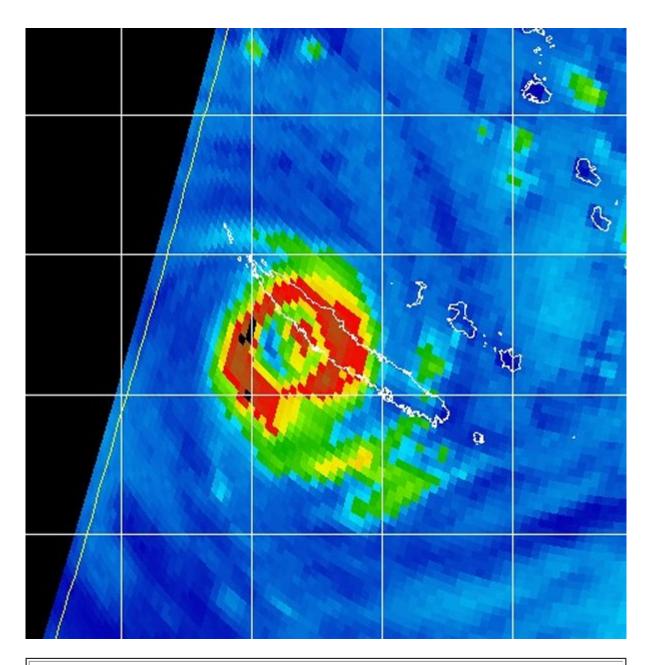
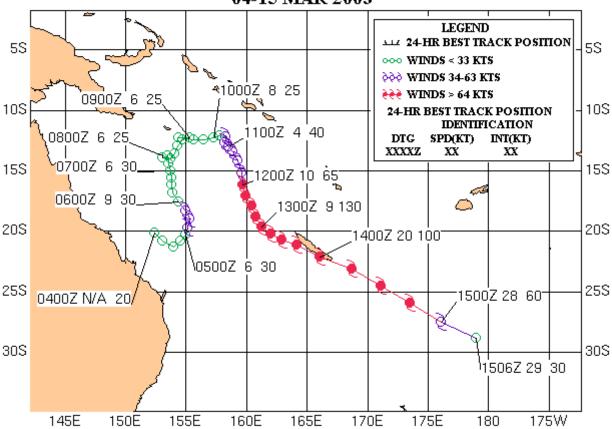
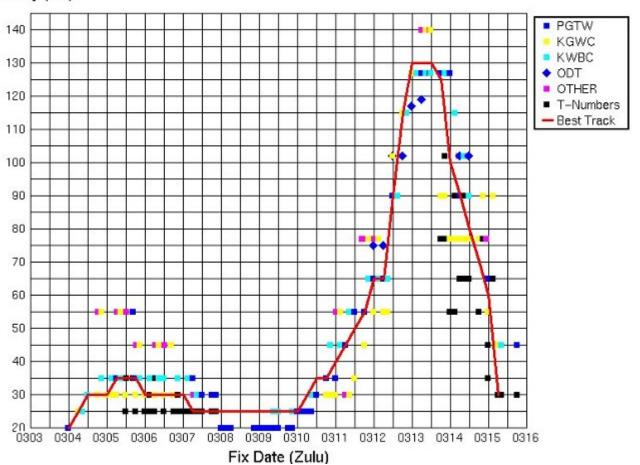


Figure 2-22P-3. 131850Z March 2003 85 GHz SSM/I imagery of TC 22P (Erica), 905 nm east of Cairns, Australia, with an increasing intensity of 100 knots.

### TROPICAL CYCLONE 22P (ERICA) 04-15 MAR 2003



## Time Intensity for 22P



## Tropical Cyclone (TC) 23S (Kalunde)\*



First Poor: 1800Z 03 Mar 03

First Fair: 0330Z 04 Mar 03

First TCFA: 2130Z 04 Mar 03

First Warning: 0600Z 05 Mar 03

Last Warning: 1200Z 15 Mar 03, Extratropical

Max Intensity: 140 kts, gusts to 170 kts

Landfall: None

Total Warnings: 21 plus 2 Amended Warnings

### Remarks:

- (1) Tropical Cyclone (TC) 23S developed approximately 445 nm southeast of Diego Garcia around 03 March 2003. The cyclone remained quasi-stationary for 48 hours then began to track southwestward toward a weakness in the mid-level subtropical ridge. As it tracked it intensfied, developed and eye, then rapidly intensified to 140 knots in a favorable upper level environment, with excellent outflow aloft and very weak vertical wind shear. TC 23S then began to track southwestward and weaken over the next 48 hours as the eye dissipated and the cyclone lost some outflow. Afterwards, the cyclone tracked poleward, rapidly weakened and transitioned into an extratropical system.
- (2) No damage was reported for this system.

## Statistics for JTWC on TC23S

|          | WRN BEST TRACK POSITIO |       |       |      |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
|----------|------------------------|-------|-------|------|----|-----|-----|-----|-----|----|----|-----|-----|------|-----|-----|-----|----|----|-----|
|          | WRN                    | BEST  | TRACK |      | РО | SIT | ION | ERR | ORS |    |    |     | WIN | ID E | RRC | DRS |     |    |    |     |
| DTG      | NO.                    | LAT   | LONG  | wind | 00 | 12  | 24  | 36  | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03030318 |                        | 10.7S | 78.4E | 15   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030400 |                        | 10.9S | 78.5E | 15   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030406 |                        | 11.2S | 78.6E | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030412 |                        | 11.5S | 78.7E | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030418 |                        | 11.5S | 78.4E | 30   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030500 |                        | 11.5S | 78.0E | 35   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03030506 | 1                      | 11.3S | 77.5E | 30   | 8  | 31  | 34  | 8   | 50  |    |    |     | 5   | 5    | 10  | 10  | 0   |    |    |     |
| 03030518 | 2                      | 10.9S | 76.7E | 40   | 11 | 40  | 35  | 12  | 48  |    |    |     | 0   | 5    | 5   | -5  | -25 |    |    |     |
| 03030600 | 2A                     | 11.1S | 76.5E | 40   | 37 | 62  | 116 | 178 | 245 |    |    |     | 0   | -5   | -5  | -30 | -50 |    |    |     |
| 03030606 | 3                      | 11.2S | 76.2E | 45   | 8  | 19  | 59  | 124 | 192 |    |    |     | 0   | 0    | -10 | -30 | -60 |    |    |     |
| 03030618 | 4                      | 11.8S | 75.0E | 55   | 0  | 13  | 34  | 71  | 99  |    |    |     | -5  | -10  | -30 | -55 | -40 |    |    |     |
| 03030706 | 5                      | 12.5S | 73.6E | 75   | 8  | 29  | 47  | 52  | 52  |    |    |     | 5   | -15  | -40 | -25 | -10 |    |    |     |
| 03030718 | 6                      | 13.4S | 72.0E | 105  | 8  | 47  | 59  | 37  | 76  |    |    |     | 10  | -15  | 0   | 15  | 25  |    |    |     |
| 03030800 | 6A                     | 13.7S | 71.2E | 130  | 8  | 29  | 8   | 25  | 152 |    |    |     | 10  | 15   | 30  | 40  | 45  |    |    |     |
| 03030812 | 7                      | 14.4S | 69.7E | 130  | 0  | 12  | 8   | 12  | 24  |    |    |     | 10  | 30   | 30  | 25  | 40  |    |    |     |
| 03030900 | 8                      | 15.3S | 68.8E | 120  | 5  | 33  | 58  | 73  | 122 |    |    |     | 0   | 5    | 0   | 15  | 10  |    |    |     |
| 03030912 | 9                      | 16.1S | 67.9E | 115  | 0  | 8   | 25  | 21  | 47  |    |    |     | 0   | -5   | 0   | -5  | -10 |    |    |     |
| 03031000 | 10                     | 16.7S | 67.1E | 115  | 0  | 13  | 18  | 54  | 112 |    |    |     | -15 | -10  | -15 | -20 | -30 |    |    |     |
| 03031012 | 11                     | 17.4S | 66.4E | 100  | 6  | 17  | 24  | 46  | 72  |    |    |     | -5  | -10  | -15 | -25 | -30 |    |    |     |
| 03031100 | 12                     | 17.9S | 65.6E | 100  | 0  | 25  | 39  | 44  | 51  |    |    |     | 0   | -5   | -15 | -25 | -20 |    |    |     |
| 03031112 | 13                     | 18.4S | 64.9E | 100  | 0  | 6   | 8   | 29  | 75  |    |    |     | 0   | -5   | -10 | 5   | 5   |    |    |     |
| 03031200 | 14                     | 18.8S | 64.3E | 105  | 0  | 6   | 41  | 84  | 115 |    |    |     | 0   | -5   | 10  | 10  | 25  |    |    |     |
| 03031212 | 15                     | 19.5S | 63.9E | 105  | 8  | 13  | 36  | 69  | 115 |    |    |     | 0   | 10   | 15  | 30  | 30  |    |    |     |
| 03031300 | 16                     | 20.5S | 64.1E | 90   | 6  | 32  | 53  | 69  | 97  |    |    |     | -15 | -15  | 0   | 5   | 10  |    |    |     |
| 03031312 | 17                     | 21.8S | 64.5E | 85   | 12 | 30  | 51  | 73  | 127 |    |    |     | -10 | 0    | 0   | 5   | 10  |    |    |     |
| 03031400 | 18                     | 23.2S | 64.9E | 65   | 28 | 53  | 55  | 111 | 130 |    |    |     | 0   | 0    | 5   | 10  | 10  |    |    |     |
| 03031412 | 19                     | 24.8S | 65.2E | 55   | 16 | 32  | 92  | 104 |     |    |    |     | -5  | 0    | 5   | 5   |     |    |    |     |
| 03031500 | 20                     | 26.5S | 65.6E | 40   | 30 | 60  | 13  |     |     |    |    |     | 0   | 5    | 5   |     |     |    |    |     |
| 03031512 | 21                     | 28.7S | 66.2E | 30   | 0  | 36  |     |     |     |    |    |     | 0   | 0    |     |     |     |    |    |     |
| 03031518 |                        | 29.6S | 66.4E | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03031600 |                        | 30.4S | 66.7E | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |

|  | AVERAGE | 9  | 28 | 41 | 62 | 100 |  | 4  | 8  | 12 | 19 | 24 |  |  |
|--|---------|----|----|----|----|-----|--|----|----|----|----|----|--|--|
|  | BIAS    |    |    |    |    |     |  | -1 | -1 | -1 | -2 | -3 |  |  |
|  | # CASES | 23 | 23 | 22 | 21 | 20  |  | 23 | 23 | 22 | 21 | 20 |  |  |

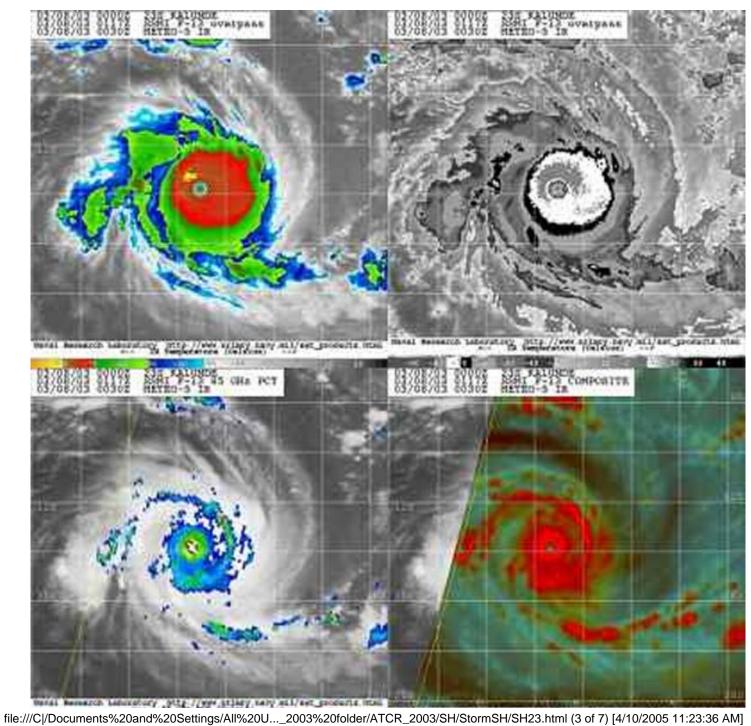




Figure 2-23S-1. 080117Z March 2003 multi-sensor satellite images of TC 23S (Kalunde), The eye is 400 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.

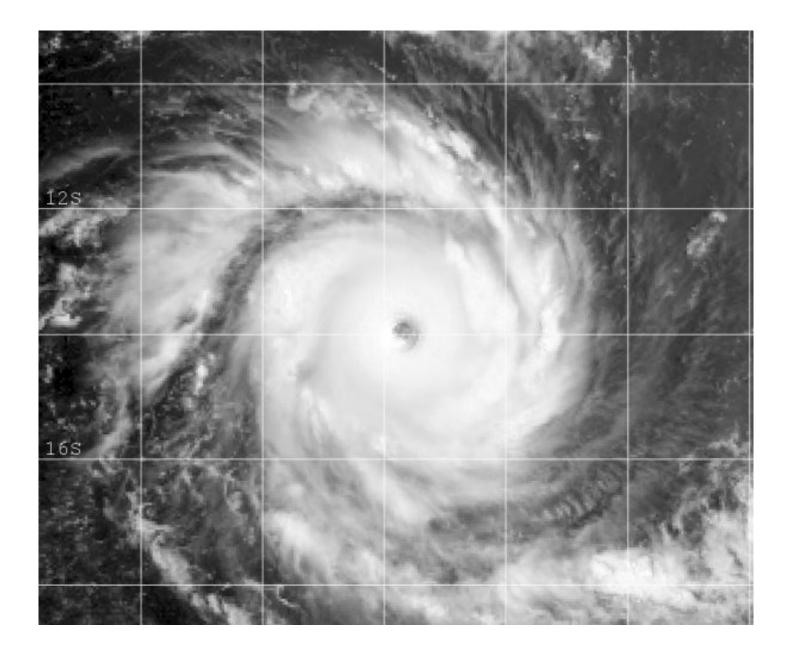


Figure 2-23S-2. 080600Z March 2003 met-5 visible image of TC 23S (Kalunde), The eye is 380 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.

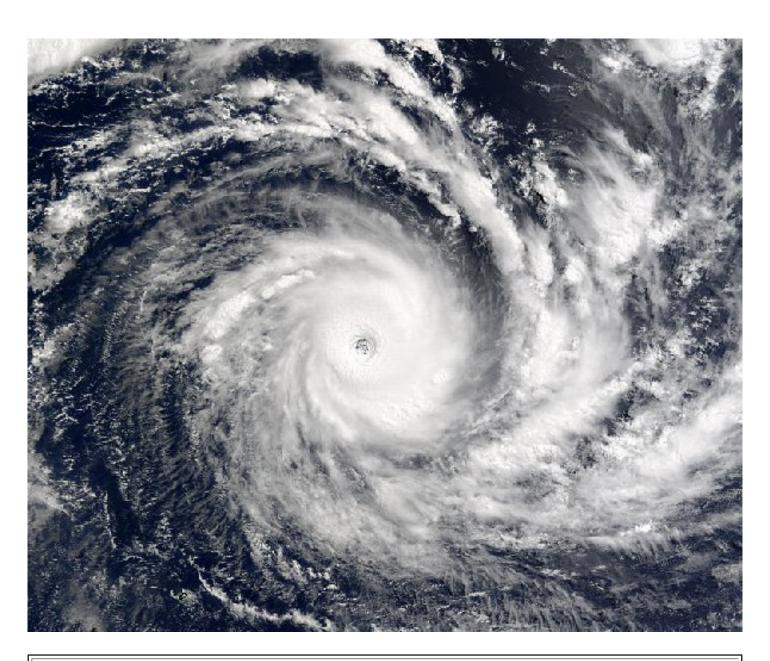
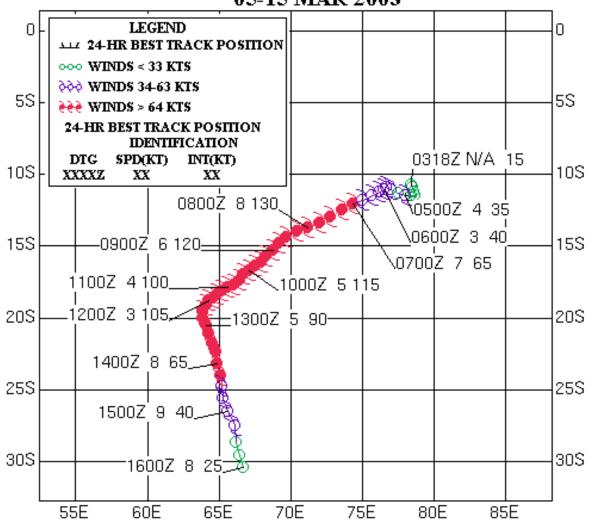
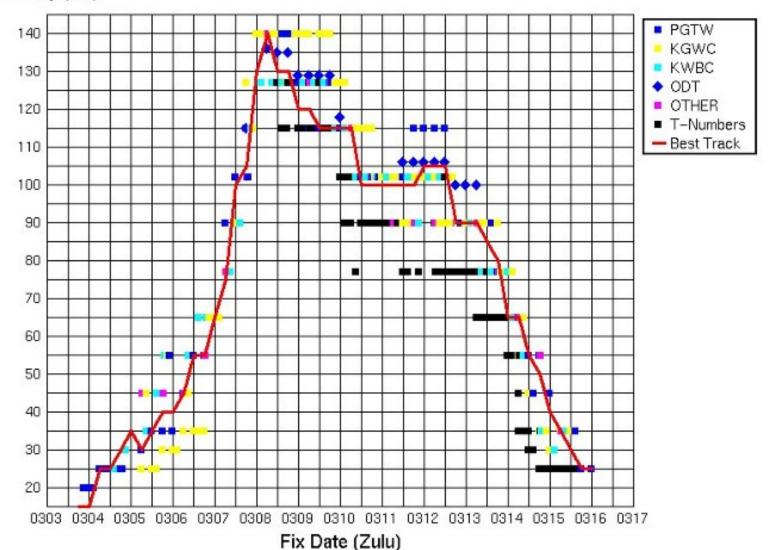


Figure 2-23S-3. 090535Z March 2003 MODIS true-color image of TC 23S (Kalunde), located 670nm east-northeast of Mauritius, with an intensity of 120 knots.

### TROPICAL CYCLONE 23S (KALUNDE) 05-15 MAR 2003



## Time Intensity for 23S



## Tropical Cyclone (TC) 23S (Kalunde)\*



First Poor: 1800Z 03 Mar 03

First Fair: 0330Z 04 Mar 03

First TCFA: 2130Z 04 Mar 03

First Warning: 0600Z 05 Mar 03

Last Warning: 1200Z 15 Mar 03, Extratropical

Max Intensity: 140 kts, gusts to 170 kts

Landfall: None

Total Warnings: 21 plus 2 Amended Warnings

Remarks:

- (1) Tropical Cyclone (TC) 23S developed approximately 445 nm southeast of Diego Garcia around 03 March 2003. The cyclone remained quasi-stationary for 48 hours then began to track southwestward toward a weakness in the mid-level subtropical ridge. As it tracked it intensfied, developed and eye, then rapidly intensified to 140 knots in a favorable upper level environment, with excellent outflow aloft and very weak vertical wind shear. TC 23S then began to track southwestward and weaken over the next 48 hours as the eye dissipated and the cyclone lost some outflow. Afterwards, the cyclone tracked poleward, rapidly weakened and transitioned into an extratropical system.
- (2) No damage was reported for this system.

### Statistics for JTWC on TC23S WRN BEST TRACK **POSITION ERRORS** WIND ERRORS DTG NO. LAT LONG wind 00 12 24 72 96 120 36 48 72 96 120 00 12 24 36 48 03030318 10.7S 78.4E 15 10.9S 78.5E 03030400 15 03030406 11.2S 78.6E 25 03030412 11.5S 78.7E 25 03030418 11.5S 78.4E 30 03030500 11.5S 78.0E 35 03030506 1 11.3S 77.5E 31 34 8 50 0 30 8 5 5 10 10 03030518 2 10.9S 76.7E 40 11 40 35 12 48 0 5 5 -5 -25 03030600 2A 11.1S 76.5E 40 62 116 178 245 0 -5 -5 -30 -50 37 124 192 03030606 3 11.2S 76.2E 45 19 59 0 -10 | -30 -60 03030618 4 11.8S 75.0E 55 0 13 34 71 99 -5 -10 -30 -55 -40 03030706 5 12.5S 73.6E 75 29 47 52 52 -15 -40 -25 -10 8 5 03030718 6 13.4S 72.0E 105 8 47 59 37 76 10 -15 0 25 15 13.7S 71.2E 25 152 03030800 6A 130 8 29 8 10 15 30 40 45 14.4S 69.7E 12 8 12 24 40 03030812 7 130 0 10 30 30 25 15.3S 68.8E 122 03030900 8 120 5 33 58 73 0 5 0 15 10 03030912 9 16.1S 67.9E 8 25 47 115 0 21 0 -5 0 -5 -10 13 18 03031000 10 16.7S 67.1E 115 0 54 112 -15 -10 -15 -20 -30 72 03031012 11 17.4S 66.4E 100 17 24 46 -5 -10 -15 -25 -30 6 03031100 12 17.9S 65.6E 100 0 25 39 44 51 -5 -15 -25 -20 0 03031112 13 18.4S 64.9E 75 -10 5 100 6 8 29 0 -5 5 0 03031200 14 18.8S 64.3E 115 105 10 6 41 84 0 -5 10 10 25 03031212 15 19.5S 63.9E 115 105 8 13 | 36 69 0 10 15 30 30 03031300 16 20.5S 64.1E 90 32 53 69 97 -15 -15 0 5 10 6 03031312 17 21.8S 64.5E 85 12 30 51 73 127 -10 0 0 5 10 03031400 18 23.2S 64.9E 28 53 55 111 130 10 65 0 0 5 10 5 03031412 19 24.8S 65.2E 55 16 32 92 104 -5 0 5 03031500 20 26.5S 65.6E 40 30 60 13 5 5 0 03031512 21 28.7S 66.2E 30 36 0 0 03031518 29.6S 66.4E 25 03031600 66.7E 30.4S 25 **AVERAGE** 9 28 41 100 62 4 8 12 19 24 **BIAS** -1 -1 -2 -1 -3 # CASES 23 23 22 21 20 23 23 22 21 20

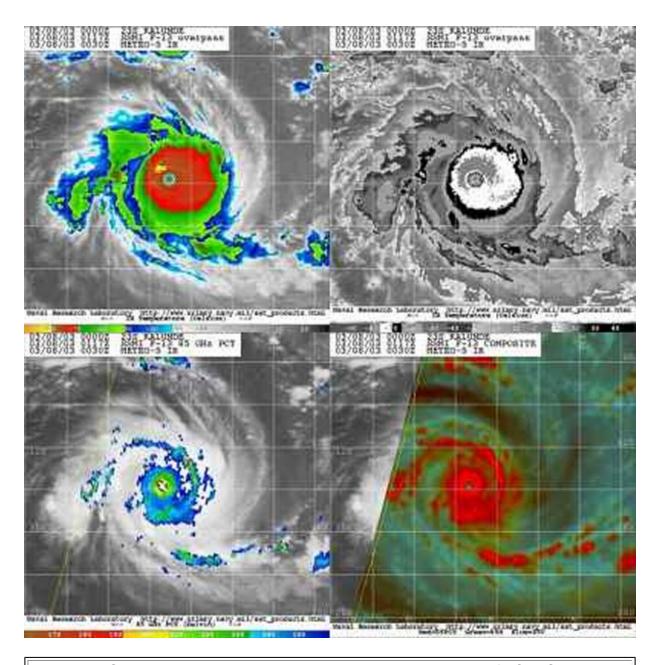


Figure 2-23S-1. 080117Z March 2003 multi-sensor satellite images of TC 23S (Kalunde), The eye is 400 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.

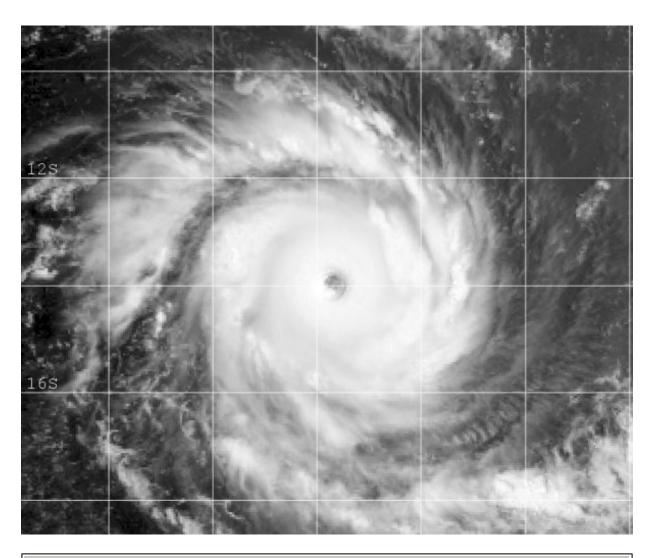


Figure 2-23S-2. 080600Z March 2003 met-5 visible image of TC 23S (Kalunde), The eye is 380 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.

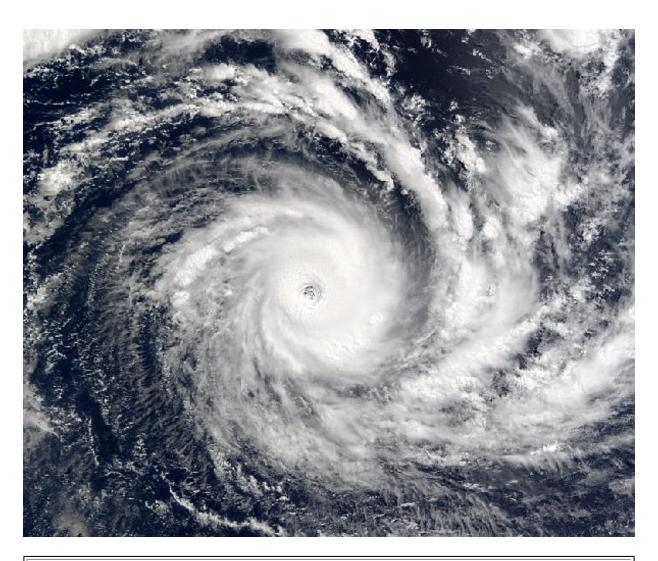
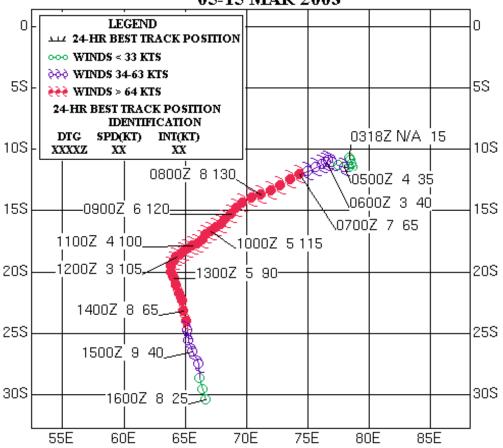
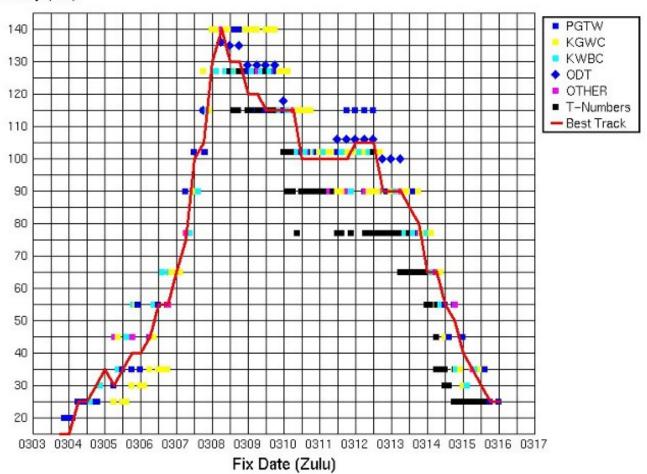


Figure 2-23S-3. 090535Z March 2003 MODIS true-color image of TC 23S (Kalunde), located 670nm east-northeast of Mauritius, with an intensity of 120 knots.

# TROPICAL CYCLONE 23S (KALUNDE) 05-15 MAR 2003



## Time Intensity for 23S



## Tropical Cyclone (TC) 24S (Craig)\*



First Poor: N/A

First Fair: 0300Z 08 Mar 03

First TCFA: 1000Z 08 Mar 03

First Warning: 1800Z 08 Mar 03

Last Warning: 1800Z 12 Mar 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Multiple Events (see below)

Total Warnings: 9

Remarks:

- (1) Tropical Cyclone (TC) 24S developed approximately 100 nm northwest of Darwin, Australia on 08 March, 2003 in a near equatorial trough. The cyclone initially drifted northward, then eastward, increasing speed as it tracked across northern Arnhem Land and intensified to 35 knots. TC 24S maintained 35 knots as it tracked into the Gulf of Carpentaria and then dissipated after moving onto the Cape York Peninsula.
- (2) Reports indicated damage from storm-force winds and fallen trees.

| 04 41  |          |          |      | 0040        |
|--------|----------|----------|------|-------------|
| Static | tics for | 11111111 | on I | ( · · ) / S |
|        |          |          |      | TO TO I     |

|          | WRN | BEST  | TRACK   |      | PO | SITIO | ON E | RRO | RS  |    |    |     | WII | ND | ERR | OR | S  |    |    |     |
|----------|-----|-------|---------|------|----|-------|------|-----|-----|----|----|-----|-----|----|-----|----|----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12    | 24   | 36  | 48  | 72 | 96 | 120 | 00  | 12 | 24  | 36 | 48 | 72 | 96 | 120 |
| 03030800 |     | 12.0S | 129.0E  | 20   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03030806 |     | 11.8S | 128.8E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03030812 |     | 11.5S | 128.8E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
| 03030818 | 1   | 11.2S | 128.8E  | 25   | 5  | 45    | 78   | 93  | 88  |    |    |     | 0   | 5  | 5   | 5  | 10 |    |    |     |
| 03030906 | 2   | 10.6S | 129.6E  | 25   | 13 | 36    | 77   | 130 | 129 |    |    |     | 5   | 5  | 5   | 10 | 15 |    |    |     |
| 03030918 | 3   | 10.8S | 130.5E  | 30   | 25 | 69    | 116  | 118 | 47  |    |    |     | 0   | 0  | 5   | 10 | 15 |    |    |     |
| 03031006 | 4   | 11.1S | 131.0E  | 35   | 13 | 34    | 19   | 108 | 284 |    |    |     | 0   | 0  | 0   | -5 | -5 |    |    |     |
| 03031018 | 5   | 11.6S | 131.5E  | 35   | 18 | 35    | 155  | 331 | 443 |    |    |     | 0   | 0  | 0   | -5 | 0  |    |    |     |
| 03031106 | 6   | 11.9S | 132.8E  | 35   | 5  | 101   | 263  | 309 |     |    |    |     | 0   | -5 | -10 | -5 |    |    |    |     |
| 03031118 | 7   | 12.6S | 135.8E  | 35   | 58 | 197   | 279  |     |     |    |    |     | 0   | 0  | 5   |    |    |    |    |     |
| 03031206 | 8   | 14.1S | 139.8E  | 35   | 21 | 90    |      |     |     |    |    |     | 0   | 0  |     |    |    |    |    |     |
| 03031218 | 9   | 16.4S | 142.2E  | 30   | 13 |       |      |     |     |    |    |     | 0   |    |     |    |    |    |    |     |
| 03031300 |     | 17.8S | 142.6E  | 25   |    |       |      |     |     |    |    |     |     |    |     |    |    |    |    |     |
|          |     |       | AVERAGE |      | 19 | 76    | 141  | 182 | 198 |    |    |     | 1   | 2  | 4   | 7  | 9  |    |    |     |
|          |     |       | BIAS    |      |    |       |      |     |     |    |    |     | 1   | 1  | 1   | 2  | 7  |    |    |     |
|          |     |       | # CASES |      | 9  | 8     | 7    | 6   | 5   |    |    |     | 9   | 8  | 7   | 6  | 5  |    |    |     |

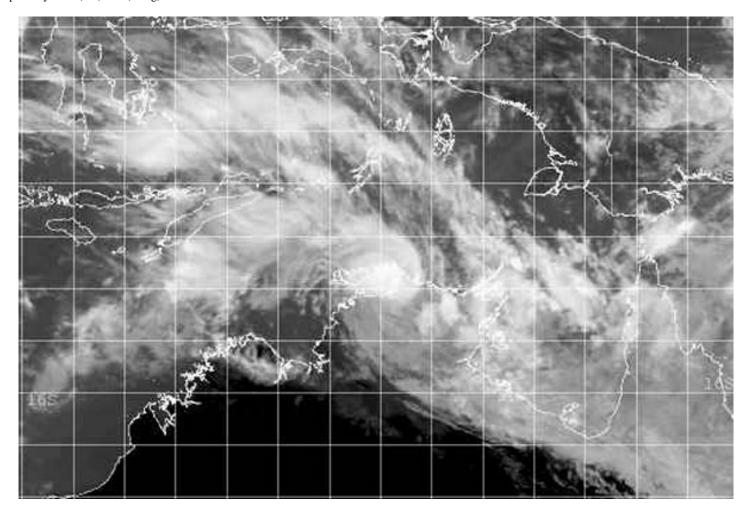
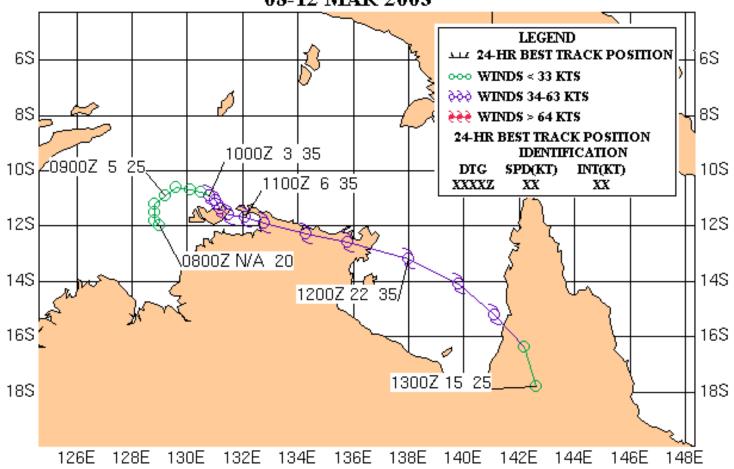
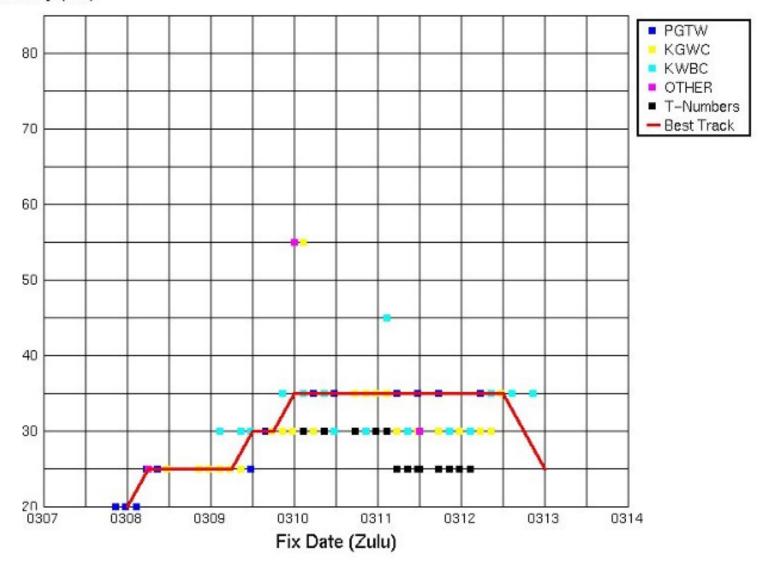


Figure 2-24S-1. 110231Z March 2003 GMS-5 infrared image of TC 24S (Craig), 100 nm northeast of Darwin, Australia, prior to landfall, with a maximum intensity of 40 knots.

### TROPICAL CYCLONE 24S (CRAIG) 08-12 MAR 2003



## Time Intensity for 24S



## Tropical Cyclone (TC) 24S (Craig)\*



First Poor: N/A

First Fair: 0300Z 08 Mar 03

First TCFA: 1000Z 08 Mar 03

First Warning: 1800Z 08 Mar 03

Last Warning: 1800Z 12 Mar 03, Dissipated

Max Intensity: 35 kts, gusts to 45 kts

Landfall: Multiple Events (see below)

Total Warnings: 9

Remarks:

- (1) Tropical Cyclone (TC) 24S developed approximately 100 nm northwest of Darwin, Australia on 08 March, 2003 in a near equatorial trough. The cyclone initially drifted northward, then eastward, increasing speed as it tracked across northern Arnhem Land and intensified to 35 knots. TC 24S maintained 35 knots as it tracked into the Gulf of Carpentaria and then dissipated after moving onto the Cape York Peninsula.
- (2) Reports indicated damage from storm-force winds and fallen trees.

|          |     |        |         | Statis | stic | s fo  | r JT\ | NC d | on T( | C24 | IS |     |     |    |     |    |    |    |    |     |
|----------|-----|--------|---------|--------|------|-------|-------|------|-------|-----|----|-----|-----|----|-----|----|----|----|----|-----|
|          |     |        |         |        |      |       |       |      |       |     |    |     |     |    |     |    |    |    |    |     |
|          | WRN | BEST 1 | ΓRACK   |        | PC   | SITIO | ON E  | RRO  | RS    |     |    |     | WII | ND | ERR | OR | S  |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind   | 00   | 12    | 24    | 36   | 48    | 72  | 96 | 120 | 00  | 12 | 24  | 36 | 48 | 72 | 96 | 120 |
| 03030800 |     | 12.0S  | 129.0E  | 20     |      |       |       |      |       |     |    |     |     |    |     |    |    |    |    |     |
| 03030806 |     | 11.8S  | 128.8E  | 25     |      |       |       |      |       |     |    |     |     |    |     |    |    |    |    |     |
| 03030812 |     | 11.5S  | 128.8E  | 25     |      |       |       |      |       |     |    |     |     |    |     |    |    |    |    |     |
| 03030818 | 1   | 11.2S  | 128.8E  | 25     | 5    | 45    | 78    | 93   | 88    |     |    |     | 0   | 5  | 5   | 5  | 10 |    |    |     |
| 03030906 | 2   | 10.6S  | 129.6E  | 25     | 13   | 36    | 77    | 130  | 129   |     |    |     | 5   | 5  | 5   | 10 | 15 |    |    |     |
| 03030918 | 3   | 10.8S  | 130.5E  | 30     | 25   | 69    | 116   | 118  | 47    |     |    |     | 0   | 0  | 5   | 10 | 15 |    |    |     |
| 03031006 | 4   | 11.1S  | 131.0E  | 35     | 13   | 34    | 19    | 108  | 284   |     |    |     | 0   | 0  | 0   | -5 | -5 |    |    |     |
| 03031018 | 5   | 11.6S  | 131.5E  | 35     | 18   | 35    | 155   | 331  | 443   |     |    |     | 0   | 0  | 0   | -5 | 0  |    |    |     |
| 03031106 | 6   | 11.9S  | 132.8E  | 35     | 5    | 101   | 263   | 309  |       |     |    |     | 0   | -5 | -10 | -5 |    |    |    |     |
| 03031118 | 7   | 12.6S  | 135.8E  | 35     | 58   | 197   | 279   |      |       |     |    |     | 0   | 0  | 5   |    |    |    |    |     |
| 03031206 | 8   | 14.1S  | 139.8E  | 35     | 21   | 90    |       |      |       |     |    |     | 0   | 0  |     |    |    |    |    |     |
| 03031218 | 9   | 16.4S  | 142.2E  | 30     | 13   |       |       |      |       |     |    |     | 0   |    |     |    |    |    |    |     |
| 03031300 |     | 17.8S  | 142.6E  | 25     |      |       |       |      |       |     |    |     |     |    |     |    |    |    |    |     |
|          |     |        | AVERAGE |        | 19   | 76    | 141   | 182  | 198   |     |    |     | 1   | 2  | 4   | 7  | 9  |    |    |     |
|          |     |        | BIAS    |        |      |       |       |      |       |     |    |     | 1   | 1  | 1   | 2  | 7  |    |    |     |

# CASES

9 8

7

6

5

9 8

6 5

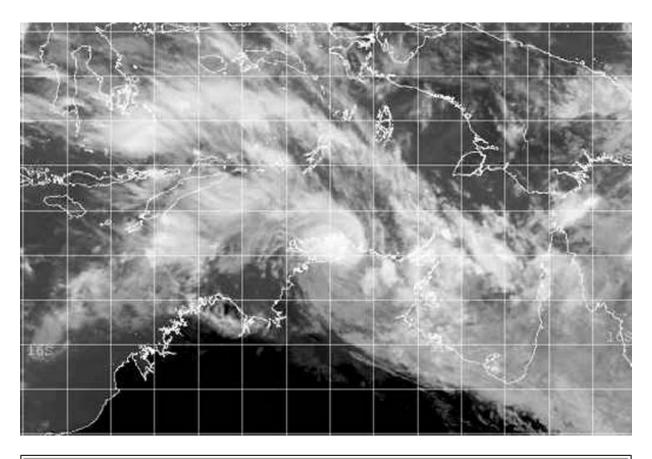
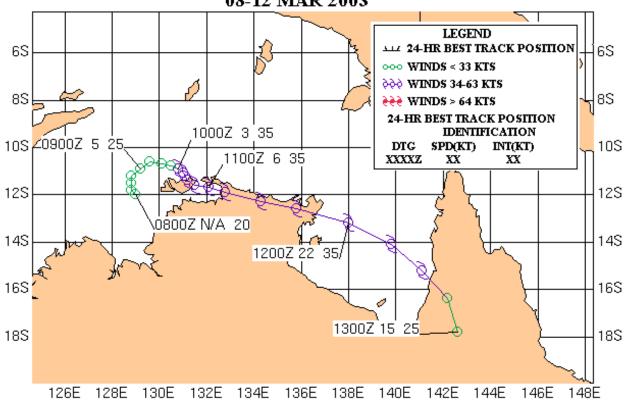
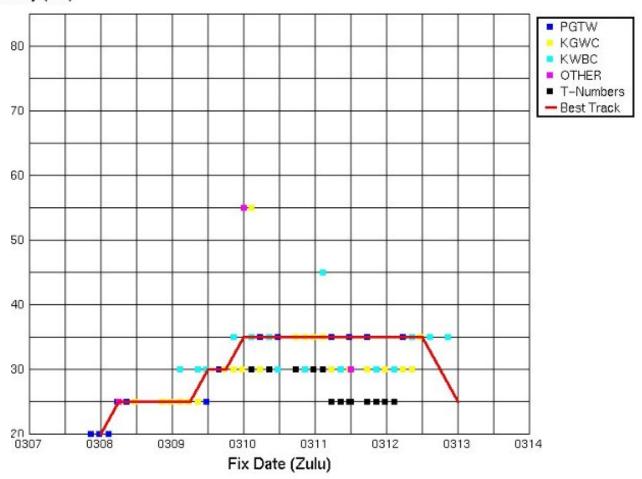


Figure 2-24S-1. 110231Z March 2003 GMS-5 infrared image of TC 24S (Craig), 100 nm northeast of Darwin, Australia, prior to landfall, with a maximum intensity of 40 knots.

# TROPICAL CYCLONE 24S (CRAIG) 08-12 MAR 2003



## Time Intensity for 24S



## Tropical Cyclone (TC) 25P (Eseta)\*



First Poor: 0100Z 09 Mar 03

First Fair: 0600Z 09 Mar 03

First TCFA: 0030Z 10 Mar 03

First Warning: 1200Z 10 Mar 03

Last Warning: 0000Z 14 Mar 03, Extratropical

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 8

Remarks:

(1) Tropical Cyclone (TC) 25P was initially described as a tropical disturbance in the North Fiji Basin on 10 March, 2003. Approximately 12 hours later JTWC issued the first warning on this cyclone. The system was intensifying at a less than climatological rate and moving south along the western periphery low to mid tropospheric subtropical ridge.

Approximately 36 hours after the initial warning the cyclone began to move east-southeast just south of Fiji, in response to steering flow associated with a mid level ridge to the east-northeast of the cyclone. By 13 March at 1200Z, TC 25P attained maximum intensity of 110 kts due to increased diffluence aloft and then began to track east-southeastward. Rapid weakening occured as TC 25P underwent extratropical transition as a result of the interaction with a developing mid-latitude low north of New Zealand.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

|          |     |       |         | Stati | stic | cs fo | or JT | WC  | on 1 | ΓC2 | 25P |     |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|-------|-------|-----|------|-----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PC   | SITI  | ON E  | RRC | RS   |     |     |     | WII | ND E | ERR | ORS | 3   |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12    | 24    | 36  | 48   | 72  | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03030818 |     | 14.0S | 171.6E  | 15    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03030900 |     | 13.9S | 171.9E  | 15    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03030906 |     | 14.1S | 172.1E  | 25    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03030912 |     | 14.3S | 172.3E  | 25    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03030918 |     | 14.6S | 172.5E  | 25    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03031000 |     | 15.1S | 172.6E  | 25    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03031006 |     | 15.6S | 172.5E  | 25    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03031012 | 1   | 16.2S | 172.4E  | 35    | 13   | 83    | 133   | 228 | 284  |     |     |     | -5  | -10  | -15 | -20 | -20 |    |    |     |
| 03031100 | 2   | 18.0S | 172.2E  | 45    | 6    | 42    | 115   | 205 | 349  |     |     |     | 0   | -5   | -10 | -10 | -35 |    |    |     |
| 03031112 | 3   | 19.6S | 173.2E  | 55    | 16   | 66    | 121   | 173 | 265  |     |     |     | 0   | -10  | -20 | -50 | -65 |    |    |     |
| 03031200 | 4   | 21.4S | 175.0E  | 65    | 8    | 29    | 73    | 144 | 303  |     |     |     | 0   | 0    | -35 | -55 | -15 |    |    |     |
| 03031212 | 5   | 21.8S | 178.1E  | 70    | 11   | 29    | 97    |     |      |     |     |     | 0   | -35  | -50 |     |     |    |    |     |
| 03031300 | 6   | 21.9S | 177.8W  | 100   | 0    | 58    | 182   | 371 |      |     |     |     | 0   | -20  | 5   | 20  |     |    |    |     |
| 03031312 | 7   | 22.9S | 172.5W  | 110   | 0    | 50    | 120   |     |      |     |     |     | 0   | 25   | 35  |     |     |    |    |     |
| 03031400 | 8   | 25.3S | 165.6W  | 65    | 97   | 217   |       |     |      |     |     |     | -5  | 0    |     |     |     |    |    |     |
| 03031406 |     | 27.5S | 161.1W  | 55    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
| 03031412 |     | 30.5S | 156.9W  | 45    |      |       |       |     |      |     |     |     |     |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 19   | 72    | 120   | 224 | 300  |     |     |     | 1   | 13   | 24  | 31  | 34  |    |    |     |
|          |     |       | BIAS    |       |      |       |       |     |      |     |     |     | -1  | -7   | -13 | -23 | -34 |    |    |     |
|          |     |       | # CASES |       | 8    | 8     | 7     | 5   | 4    |     |     |     | 8   | 8    | 7   | 5   | 4   |    |    |     |

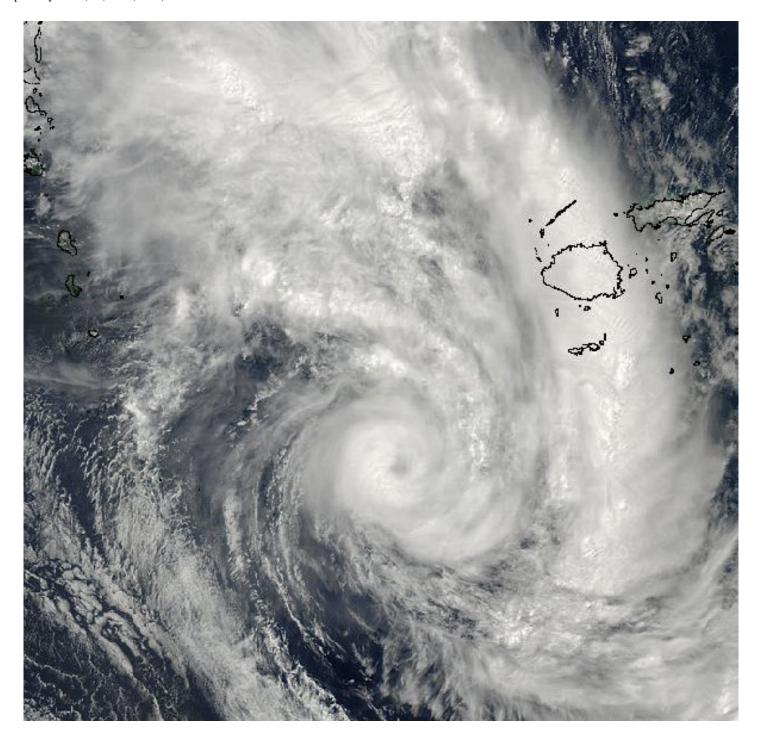


Figure 2-25P-1. 120215Z March 2003 MODIS true-color image of TC 25P (Eseta), located 250nm southwest of the Fiji Islands, with an intensity of 65 knots.

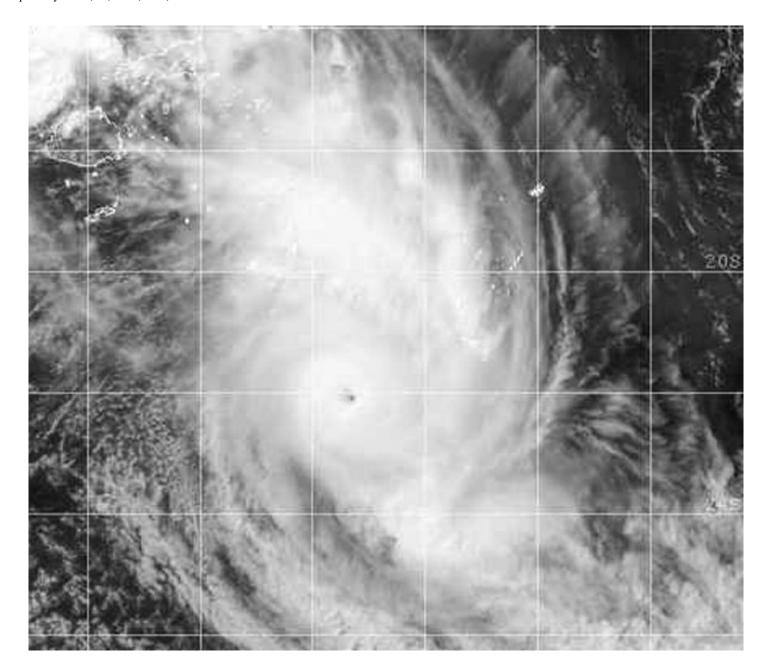


Figure 2-25P-2. 130133Z March 2003 GOES-10 visible imagery of TC 25P (Eseta), 378 nm southeast of Suva, Fiji, with an increasing intensity of 100 knots.

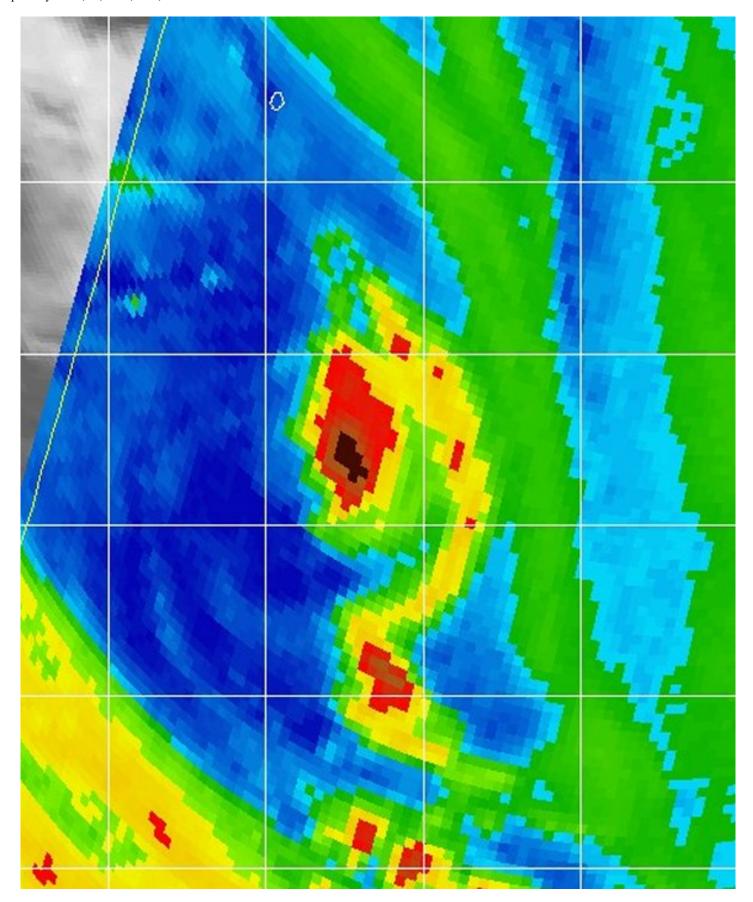
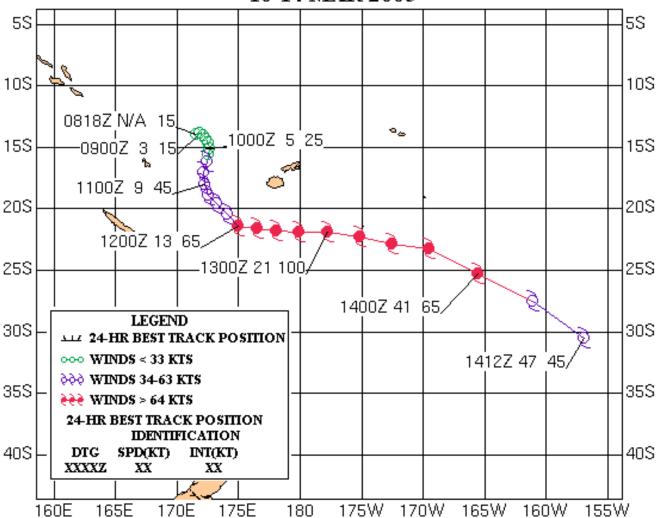
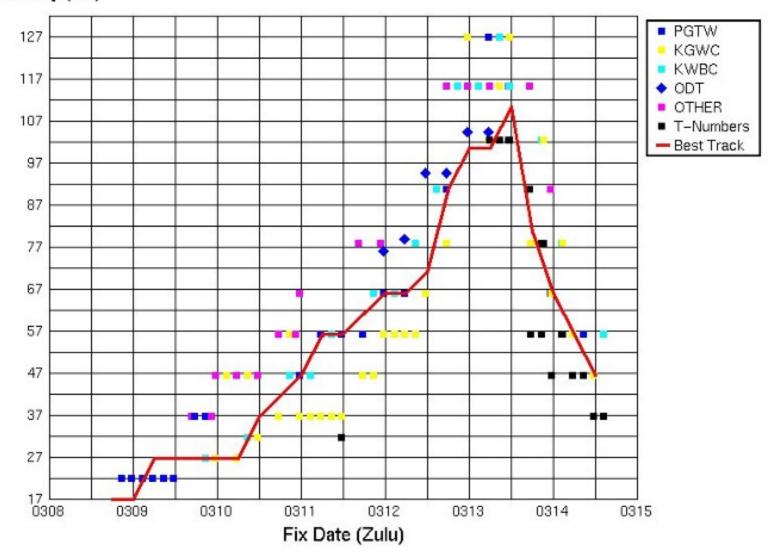


Figure 2-25P-3. 131708Z March 2003 85 GHz SSM/I imagery of TC 25P (Eseta), 340 nm southeast of Suva, Fiji, with an increasing intensity of 80 knots.





# Time Intensity for 25P



## Tropical Cyclone (TC) 25P (Eseta)\*



First Poor: 0100Z 09 Mar 03

First Fair: 0600Z 09 Mar 03

First TCFA: 0030Z 10 Mar 03

First Warning: 1200Z 10 Mar 03

Last Warning: 0000Z 14 Mar 03, Extratropical

Max Intensity: 110 kts, gusts to 135 kts

Landfall: None

Total Warnings: 8

Remarks:

(1) Tropical Cyclone (TC) 25P was initially described as a tropical disturbance in the North Fiji Basin on 10 March, 2003. Approximately 12 hours later JTWC issued the first warning on this cyclone. The system was intensifying at a less than climatological rate and moving south along the western periphery low to mid tropospheric subtropical ridge.

Approximately 36 hours after the initial warning the cyclone began to move east-southeast just south of Fiji, in response to steering flow associated with a mid level ridge to the east-northeast of the cyclone. By 13 March at 1200Z, TC 25P attained maximum intensity of 110 kts due to increased diffluence aloft and then began to track east-southeastward. Rapid weakening occured as TC 25P underwent extratropical transition as a result of the interaction with a developing mid-latitude low north of New Zealand.

(2) Available reports indicate no casualties or damage were associated with this cyclone.

|          |     |        |         | Stati | stic | cs fo | or JT | WC  | on 1 | ΓC2 | 25P |     |    |      |     |     |     |    |    |     |
|----------|-----|--------|---------|-------|------|-------|-------|-----|------|-----|-----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |        |         |       |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST T | TRACK   |       | PC   | SITI  | ON E  | RRC | RS   |     |     |     | WI | ND E | ERR | ORS | ;   |    |    |     |
| DTG      | NO. | LAT    | LONG    | wind  | 00   | 12    | 24    | 36  | 48   | 72  | 96  | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03030818 |     | 14.0S  | 171.6E  | 15    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03030900 |     | 13.9S  | 171.9E  | 15    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03030906 |     | 14.1S  | 172.1E  | 25    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03030912 |     | 14.3S  | 172.3E  | 25    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03030918 |     | 14.6S  | 172.5E  | 25    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03031000 |     | 15.1S  | 172.6E  | 25    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03031006 |     | 15.6S  | 172.5E  | 25    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03031012 | 1   | 16.2S  | 172.4E  | 35    | 13   | 83    | 133   | 228 | 284  |     |     |     | -5 | -10  | -15 | -20 | -20 |    |    |     |
| 03031100 | 2   | 18.0S  | 172.2E  | 45    | 6    | 42    | 115   | 205 | 349  |     |     |     | 0  | -5   | -10 | -10 | -35 |    |    |     |
| 03031112 | 3   | 19.6S  | 173.2E  | 55    | 16   | 66    | 121   | 173 | 265  |     |     |     | 0  | -10  | -20 | -50 | -65 |    |    |     |
| 03031200 | 4   | 21.4S  | 175.0E  | 65    | 8    | 29    | 73    | 144 | 303  |     |     |     | 0  | 0    | -35 | -55 | -15 |    |    |     |
| 03031212 | 5   | 21.8S  | 178.1E  | 70    | 11   | 29    | 97    |     |      |     |     |     | 0  | -35  | -50 |     |     |    |    |     |
| 03031300 | 6   | 21.9S  | 177.8W  | 100   | 0    | 58    | 182   | 371 |      |     |     |     | 0  | -20  | 5   | 20  |     |    |    |     |
| 03031312 | 7   | 22.9S  | 172.5W  | 110   | 0    | 50    | 120   |     |      |     |     |     | 0  | 25   | 35  |     |     |    |    |     |
| 03031400 | 8   | 25.3S  | 165.6W  | 65    | 97   | 217   |       |     |      |     |     |     | -5 | 0    |     |     |     |    |    |     |
| 03031406 |     | 27.5S  | 161.1W  | 55    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
| 03031412 |     | 30.5S  | 156.9W  | 45    |      |       |       |     |      |     |     |     |    |      |     |     |     |    |    |     |
|          |     |        | AVERAGE |       | 19   | 72    | 120   | 224 | 300  |     |     |     | 1  | 13   | 24  | 31  | 34  |    |    |     |
|          |     |        | BIAS    |       |      |       |       |     |      |     |     |     | -1 | -7   | -13 | -23 | -34 |    |    |     |
|          |     |        | # CASES |       | 8    | 8     | 7     | 5   | 4    |     |     |     | 8  | 8    | 7   | 5   | 4   |    |    |     |

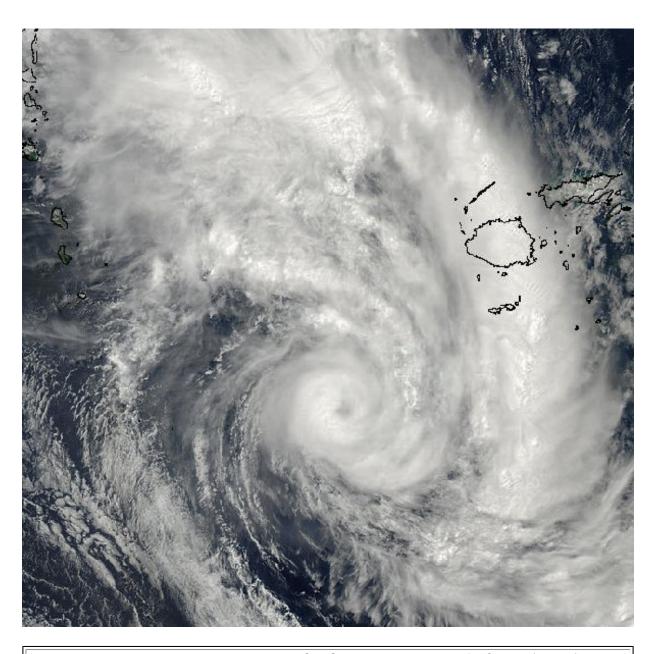


Figure 2-25P-1. 120215Z March 2003 MODIS true-color image of TC 25P (Eseta), located 250nm southwest of the Fiji Islands, with an intensity of 65 knots.

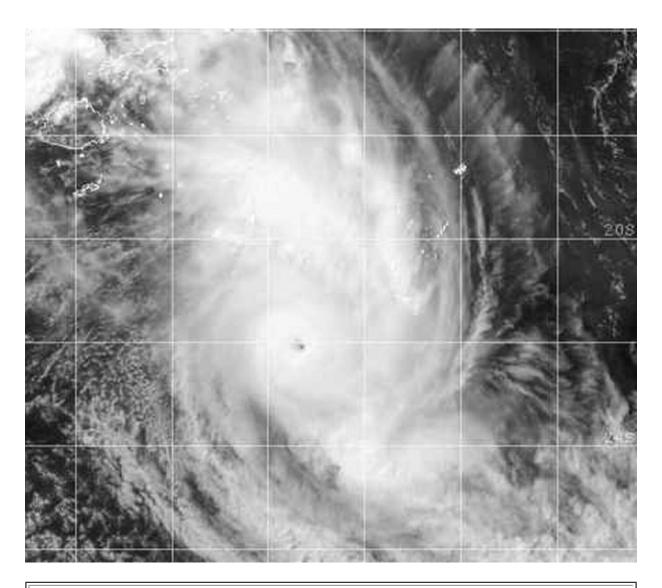


Figure 2-25P-2. 130133Z March 2003 GOES-10 visible imagery of TC 25P (Eseta), 378 nm southeast of Suva, Fiji, with an increasing intensity of 100 knots.

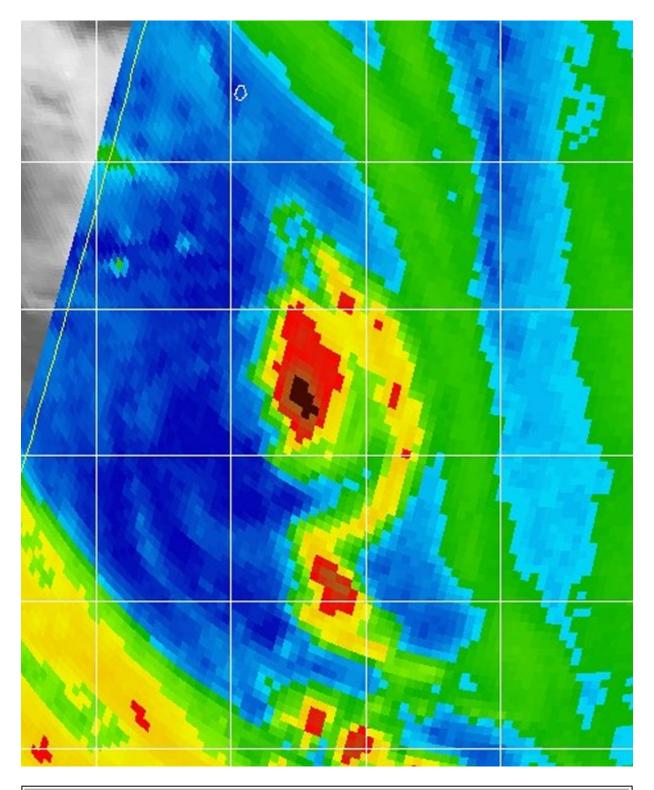
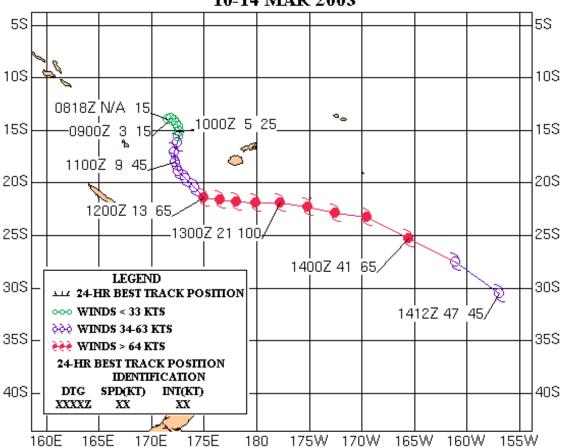
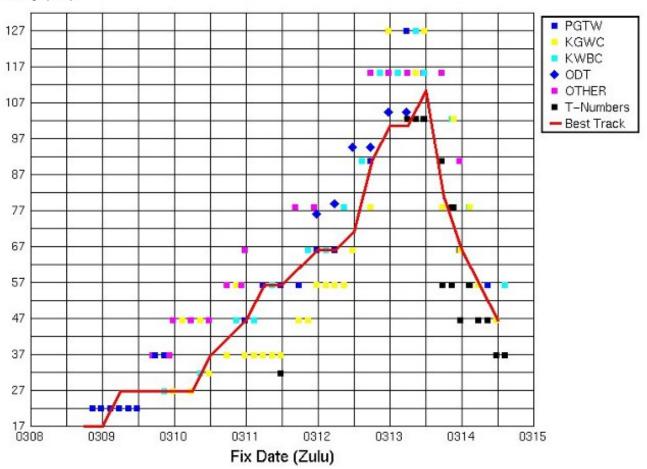


Figure 2-25P-3. 131708Z March 2003 85 GHz SSM/I imagery of TC 25P (Eseta), 340 nm southeast of Suva, Fiji, with an increasing intensity of 80 knots.

#### TROPICAL CYCLONE 25P (ESETA) 10-14 MAR 2003



# Time Intensity for 25P



## Tropical Cyclone (TC) 26S (Inigo)\*



First Poor: 0230Z 29 Mar

First Fair: 1400Z 30 Mar 03

First TCFA: 1400Z 31 Mar 03

First Warning: 1200Z 01 Apr 03

Last Warning: 1200Z 08 Apr 03, Dissipated

Max Intensity: 140 kts, gusts to 170 kts

Landfall: Near Port Hedland, Australia

Total Warnings: 23

Remarks:

(1) Tropical Cyclone (TC) 26S was initially a very poorly organized surface circulation with cycling convection in the Banda Sea, off the northeast coast of Timor. As it slowly tracked westward over East Timor into the Suva Sea, it became more organized. JTWC issued the first warning on 01 April as the system showed signs of developing banding features in the satellite imagery. Throughout its developing stage, TC 26S was equatorward of the upper level ridge axis which hampered intensification.

On 06 April, under the steering influence of the subtropical ridge to the east, TC 26S turned poleward and tracked underneath the 200mb ridge axis. In less than 24 hours following that event, TC 26S explosively intensified from a 75 knot system to a maximum intensity of 140 knots. On 08 April, TC 26S passed approximately 150 Nm northeast of Learmonth, Australia and made landfall approximately 135 mm west-southwest of Port Hedland, Australia.

(2) TC 26S dissipated soon after landfall. Minimal damage was reported with this system due to the sparse population near the landfall location.

|          |     |       |        | Sta  | tist | ics f | or J | TWC | on  | TC2 | 26S |     |    |      |     |     |     |    |    |     |
|----------|-----|-------|--------|------|------|-------|------|-----|-----|-----|-----|-----|----|------|-----|-----|-----|----|----|-----|
|          |     |       |        |      |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK  |      | PC   | SITI  | ON E | RRC | RS  |     |     |     | WI | ND E | ERR | ORS | 3   |    |    |     |
| DTG      | NO. | LAT   | LONG   | wind | 00   | 12    | 24   | 36  | 48  | 72  | 96  | 120 | 00 | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03032906 |     | 7.0S  | 130.6E | 15   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03032912 |     | 7.1S  | 129.9E | 15   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03032918 |     | 7.3S  | 129.2E | 15   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033000 |     | 7.6S  | 128.5E | 20   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033006 |     | 7.9S  | 127.8E | 25   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033012 |     | 8.2S  | 126.9E | 25   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033018 |     | 8.5S  | 126.0E | 25   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033100 |     | 8.8S  | 124.9E | 25   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033106 |     | 9.0S  | 123.8E | 30   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033112 |     | 9.4S  | 122.7E | 30   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03033118 |     | 9.5S  | 121.9E | 30   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03040100 |     | 9.48  | 121.2E | 30   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03040106 |     | 9.7S  | 120.7E | 30   |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03040112 | 1   | 10.1S | 120.3E | 35   | 6    | 34    | 72   | 103 | 103 |     |     |     | 0  | 0    | 0   | -10 | -35 |    |    |     |
| 03040200 | 2   | 10.8S | 119.3E | 45   | 8    | 37    | 101  | 112 | 94  |     |     |     | 0  | 0    | -10 | -35 | -55 |    |    |     |
| 03040212 | 3   | 11.4S | 118.5E | 55   | 5    | 35    | 54   | 74  | 65  |     |     |     | 0  | -5   | -30 | -50 | -40 |    |    |     |
| 03040300 | 4   | 11.7S | 117.9E | 75   | 16   | 34    | 43   | 65  | 81  |     |     |     | 5  | -10  | -30 | -35 | -30 |    |    |     |
| 03040312 | 5   | 12.1S | 116.9E | 110  | 0    | 12    | 26   | 30  | 33  |     |     |     | 5  | -5   | -5  | 0   | 0   |    |    |     |
| 03040400 | 6   | 12.6S | 115.8E | 140  | 8    | 21    | 21   | 24  | 21  | 29  |     |     | 0  | 0    | 10  | 10  | 25  | 55 |    |     |
| 03040412 | 7   | 13.5S | 114.6E | 140  | 6    | 18    | 38   | 62  | 85  | 77  |     |     | 0  | 10   | 10  | 25  | 25  | 50 |    |     |
| 03040518 | 8*  | 14.0S | 113.9E | 140  |      |       |      |     |     |     |     |     |    |      |     |     |     |    |    |     |
| 03040500 | 9   | 14.3S | 113.6E | 130  | 0    | 18    | 36   | 44  | 64  | 137 |     |     | 5  | 5    | 15  | 20  | 25  | 5  |    |     |
| 03040506 | 10  | 14.5S | 113.2E | 125  | 0    | 12    | 21   | 31  | 50  | 133 |     |     | 0  | 0    | 5   | 15  | 15  | 5  |    |     |
| 03040512 | 11  | 14.7S | 113.0E | 125  | 5    | 12    | 21   | 54  | 54  | 106 |     |     | -5 | 0    | 5   | 20  | 20  | 15 |    |     |
| 03040518 | 12  | 14.98 | 112.8E | 115  | 8    | 8     | 6    | 21  | 31  | 65  |     |     | -5 | -5   | 10  | 15  | 10  | 5  |    |     |
| 03040600 | 13  | 15.1S | 112.7E | 105  | 8    | 12    | 8    | 39  | 49  |     |     |     | -5 | -5   | 0   | 5   | 0   |    |    |     |

| 03040606     | 14     | 15.4S    | 112.7E       | 100   | 5   | 51     | 91  | 104 | 34  |    |     | 0  | 5  | 5   | 5  | 5  |     |  |
|--------------|--------|----------|--------------|-------|-----|--------|-----|-----|-----|----|-----|----|----|-----|----|----|-----|--|
| 03040612     | 15     | 15.8S    | 112.8E       | 90    | 11  | 42     | 38  | 58  | 102 |    |     | 0  | 5  | 5   | 0  | 10 |     |  |
| 03040618     | 16     | 16.4S    | 113.0E       | 80    | 5   | 6      | 42  | 102 | 127 |    |     | 0  | 0  | -5  | -5 | -5 |     |  |
| 03040700     | 17     | 17.0S    | 113.3E       | 70    | 0   | 25     | 69  | 83  |     |    |     | 0  | 5  | 0   | 10 |    |     |  |
| 03040706     | 18     | 17.6S    | 113.9E       | 65    | 8   | 21     | 98  | 133 |     |    |     | 0  | -5 | -10 | -5 |    |     |  |
| 03040712     | 19     | 18.3S    | 114.8E       | 55    | 0   | 62     | 84  |     |     |    |     | 5  | -5 | 0   |    |    |     |  |
| 03040718     | 20     | 19.0S    | 115.1E       | 55    | 29  | 72     | 101 |     |     |    |     | 0  | 0  | 0   |    |    |     |  |
| 03040800     | 21     | 19.9S    | 115.5E       | 50    | 17  | 129    |     |     |     |    |     | 0  | 10 |     |    |    |     |  |
| 03040806     | 22     | 20.98    | 116.2E       | 40    | 8   | 73     |     |     |     |    |     | 0  | 5  |     |    |    |     |  |
| 03040812     | 23     | 21.9S    | 117.7E       | 25    | 5   |        |     |     |     |    |     | 0  |    |     |    |    |     |  |
| 03040818     |        | 23.45    | 118.2E       | 25    |     |        |     |     |     |    |     |    |    |     |    |    |     |  |
|              |        |          | AVERAGE      |       | 8   | 35     | 51  | 67  | 66  | 91 |     | 2  | 4  | 8   | 16 | 20 | 23  |  |
|              |        |          | BIAS         |       |     |        |     |     |     |    |     | 0  | 0  | -1  | -1 | -2 | 23  |  |
|              |        |          | # CASES      |       | 22  | 21     | 19  | 17  | 15  | 6  |     | 22 | 21 | 19  | 17 | 15 | 6   |  |
| Verification | Statis | stics mi | ssing for wa | rning | nun | nber ( | 8   | ,   | ,   | ,  | , , |    | ,  | ,   | ,  | ,  | , , |  |

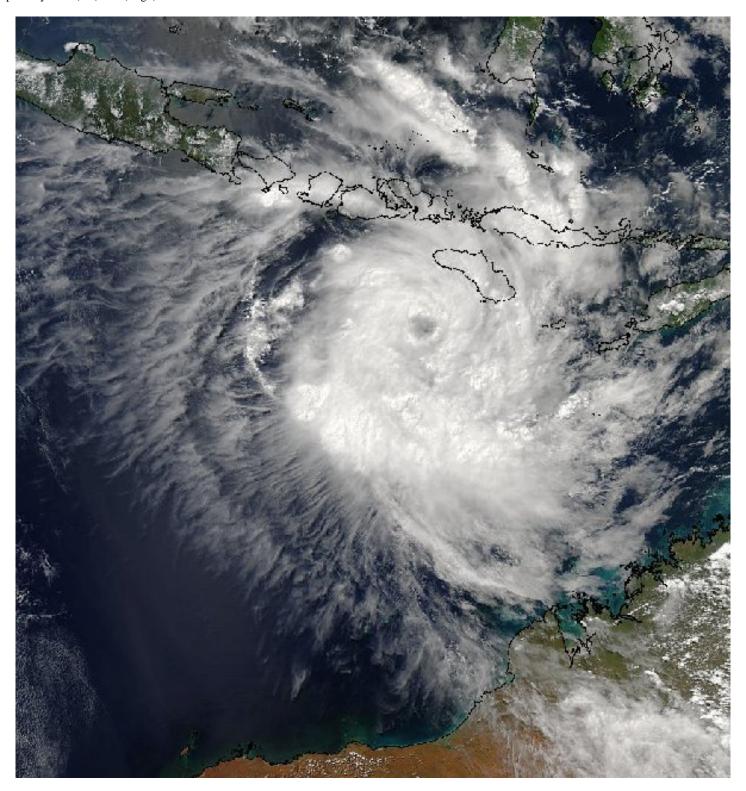


Figure 2-26S-1. 020555Z April 2003 MODIS true-color image of TC 26S (Inigo), located 440nm west-northwest of Port Warrender, Australia, with an intensity of 45 knots as it began a phase of rapid intensification.

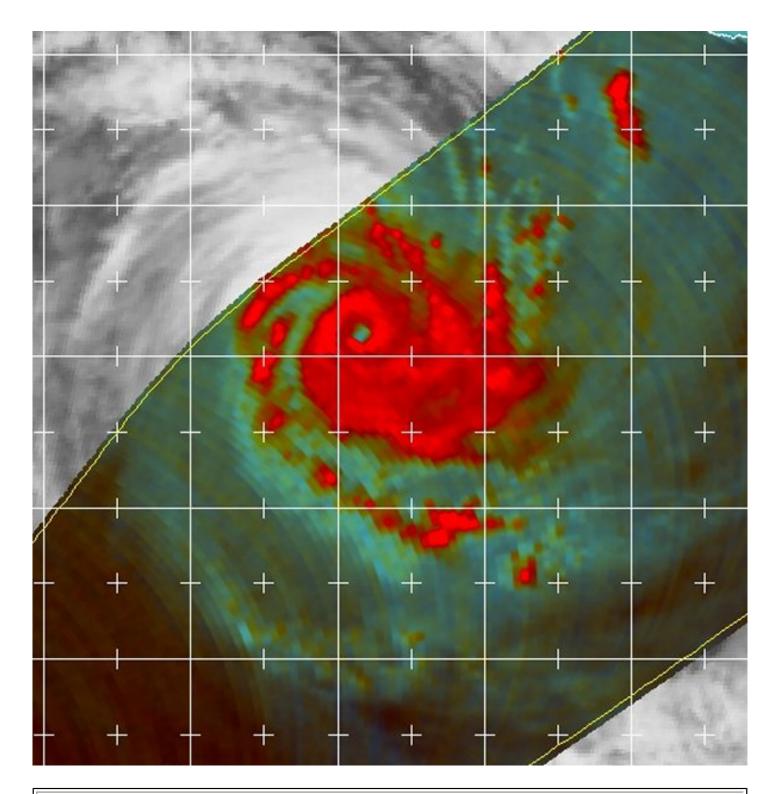


Figure 2-26S-2. 041531Z April 2003 color composite TRMM image of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

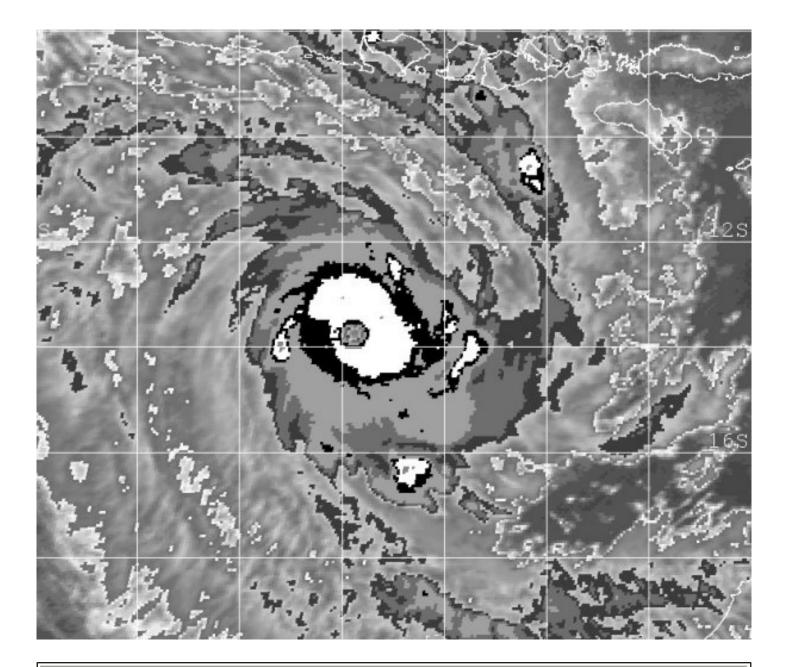
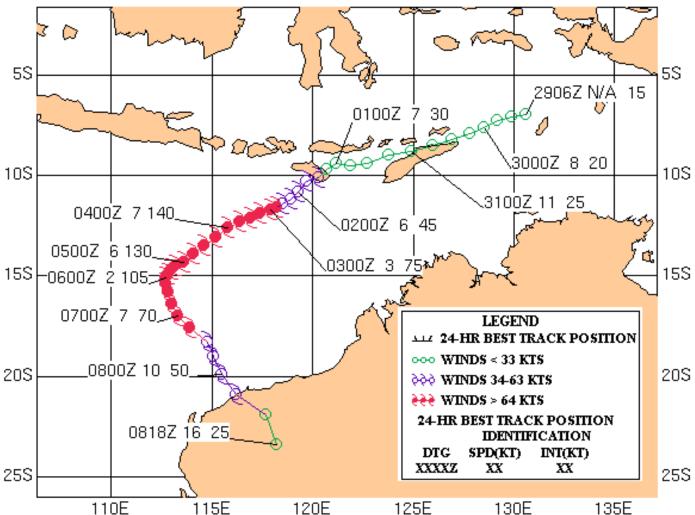
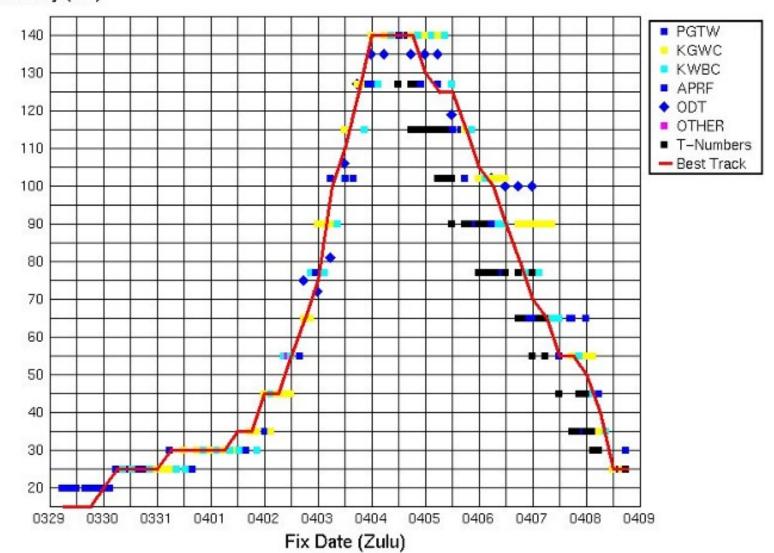


Figure 2-26S-3. 041531Z April 2003 enhanced infrared imagery of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

### TROPICAL CYCLONE 26P (INIGO) 01-08 APR 2003



# Time Intensity for 26S



### Tropical Cyclone (TC) 26S (Inigo)\*



First Poor: 0230Z 29 Mar

First Fair: 1400Z 30 Mar 03

First TCFA: 1400Z 31 Mar 03

First Warning: 1200Z 01 Apr 03

Last Warning: 1200Z 08 Apr 03, Dissipated

Max Intensity: 140 kts, gusts to 170 kts

Landfall: Near Port Hedland, Australia

Total Warnings: 23

Remarks:

(1) Tropical Cyclone (TC) 26S was initially a very poorly organized surface circulation with cycling convection in the Banda Sea, off the northeast coast of Timor. As it slowly tracked westward over East Timor into the Suva Sea, it became more organized. JTWC issued the first warning on 01 April as the system showed signs of developing banding features in the satellite imagery. Throughout its developing stage, TC 26S was equatorward of the upper level ridge axis which hampered intensification.

On 06 April, under the steering influence of the subtropical ridge to the east, TC 26S turned poleward and tracked underneath the 200mb ridge axis. In less than 24 hours following that event, TC 26S explosively intensified from a 75 knot system to a maximum intensity of 140 knots. On 08 April, TC 26S passed approximately 150 Nm northeast of Learmonth, Australia and made landfall approximately 135 mm west-southwest of Port Hedland, Australia.

(2) TC 26S dissipated soon after landfall. Minimal damage was reported with this system due to the sparse population near the landfall location.

|              | WRN    | BEST    | TRACK        |       | PC  | SITI | ON E | RRC | RS  |     |    |     | WI | ND E | ERR | ORS | 3   |     |    |     |
|--------------|--------|---------|--------------|-------|-----|------|------|-----|-----|-----|----|-----|----|------|-----|-----|-----|-----|----|-----|
| DTG          | NO.    | LAT     | LONG         | wind  | 00  | 12   | 24   | 36  | 48  | 72  | 96 | 120 | 00 | 12   | 24  | 36  | 48  | 72  | 96 | 120 |
| 03032906     |        | 7.0S    | 130.6E       | 15    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03032912     |        | 7.1S    | 129.9E       | 15    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03032918     |        | 7.3S    | 129.2E       | 15    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033000     |        | 7.6S    | 128.5E       | 20    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033006     |        | 7.9S    | 127.8E       | 25    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033012     |        | 8.2S    | 126.9E       | 25    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033018     |        | 8.5S    | 126.0E       | 25    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033100     |        | 8.8S    | 124.9E       | 25    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033106     |        | 9.0S    | 123.8E       | 30    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033112     |        | 9.4S    | 122.7E       | 30    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03033118     |        | 9.5S    | 121.9E       | 30    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03040100     |        | 9.4S    | 121.2E       | 30    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03040106     |        | 9.7S    | 120.7E       | 30    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03040112     | 1      | 10.1S   | 120.3E       | 35    | 6   | 34   | 72   | 103 | 103 |     |    |     | 0  | 0    | 0   | -10 | -35 |     |    |     |
| 03040200     | 2      | 10.8S   | 119.3E       | 45    | 8   | 37   | 101  | 112 | 94  |     |    |     | 0  | 0    | -10 | -35 | -55 |     |    |     |
| 03040212     | 3      | 11.4S   | 118.5E       | 55    | 5   | 35   | 54   | 74  | 65  |     |    |     | 0  | -5   | -30 | -50 | -40 |     |    |     |
| 03040300     | 4      | 11.7S   | 117.9E       | 75    | 16  | 34   | 43   | 65  | 81  |     |    |     | 5  | -10  | -30 | -35 | -30 |     |    |     |
| 03040312     | 5      | 12.1S   | 116.9E       | 110   | 0   | 12   | 26   | 30  | 33  |     |    |     | 5  | -5   | -5  | 0   | 0   |     |    |     |
| 03040400     | 6      | 12.6S   | 115.8E       | 140   | 8   | 21   | 21   | 24  | 21  | 29  |    |     | 0  | 0    | 10  | 10  | 25  | 55  |    |     |
| 03040412     | 7      | 13.5S   | 114.6E       | 140   | 6   | 18   | 38   | 62  | 85  | 77  |    |     | 0  | 10   | 10  | 25  | 25  | 50  |    |     |
| 03040518     | 8*     | 14.0S   | 113.9E       | 140   |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
| 03040500     | 9      | 14.3S   | 113.6E       | 130   | 0   | 18   | 36   | 44  | 64  | 137 |    |     | 5  | 5    | 15  | 20  | 25  | 5   |    |     |
| 03040506     | 10     | 14.5S   | 113.2E       | 125   | 0   | 12   | 21   | 31  | 50  | 133 |    |     | 0  | 0    | 5   | 15  | 15  | 5   |    |     |
| 03040512     | 11     | 14.7S   | 113.0E       | 125   | 5   | 12   | 21   | 54  | 54  | 106 |    |     | -5 | 0    | 5   | 20  | 20  | 15  |    |     |
| 03040518     | 12     | 14.9S   | 112.8E       | 115   | 8   | 8    | 6    | 21  | 31  | 65  |    |     | -5 | -5   | 10  | 15  | 10  | 5   |    |     |
| 03040600     | 13     | 15.1S   | 112.7E       | 105   | 8   | 12   | 8    | 39  | 49  |     |    |     | -5 | -5   | 0   | 5   | 0   |     |    |     |
| 03040606     | 14     | 15.4S   | 112.7E       | 100   | 5   | 51   | 91   | 104 | 34  |     |    |     | 0  | 5    | 5   | 5   | 5   |     |    |     |
| 03040612     | 15     | 15.8S   | 112.8E       | 90    | 11  | 42   | 38   | 58  | 102 |     |    |     | 0  | 5    | 5   | 0   | 10  |     |    |     |
| 03040618     | 16     | 16.4S   | 113.0E       | 80    | 5   | 6    | 42   | 102 | 127 |     |    |     | 0  | 0    | -5  | -5  | -5  |     |    |     |
| 03040700     | 17     | 17.0S   | 113.3E       | 70    | 0   | 25   | 69   | 83  |     |     |    |     | 0  | 5    | 0   | 10  |     |     |    |     |
| 03040706     | 18     | 17.6S   | 113.9E       | 65    | 8   | 21   | 98   | 133 |     |     |    |     | 0  | -5   | -10 | -5  |     |     |    |     |
| 03040712     | 19     | 18.3S   | 114.8E       | 55    | 0   | 62   | 84   |     |     |     |    |     | 5  | -5   | 0   |     |     |     |    |     |
| 03040718     | 20     | 19.0S   | 115.1E       | 55    | 29  | 72   | 101  |     |     |     |    |     | 0  | 0    | 0   |     |     |     |    |     |
| 03040800     | 21     | 19.98   | 115.5E       | 50    | 17  | 129  |      |     |     |     |    |     | 0  | 10   |     |     |     |     |    |     |
| 03040806     | 22     | 20.98   | 116.2E       | 40    | 8   | 73   |      |     |     |     |    |     | 0  | 5    |     |     |     |     |    |     |
| 03040812     | 23     | 21.98   | 117.7E       | 25    | 5   |      |      |     |     |     |    |     | 0  |      |     |     |     |     |    |     |
| 03040818     |        | 23.4\$  | 118.2E       | 25    |     |      |      |     |     |     |    |     |    |      |     |     |     |     |    |     |
|              |        |         | AVERAGE      |       | 8   | 35   | 51   | 67  | 66  | 91  |    |     | 2  | 4    | 8   | 16  | 20  | 23  |    |     |
|              |        |         | BIAS         |       |     |      |      |     |     |     |    |     | 0  | 0    | -1  | -1  | -2  | 23  |    |     |
|              |        |         | # CASES      |       | 22  | 21   | 19   | 17  | 15  | 6   |    |     | 22 | 21   | 19  | 17  | 15  | 6   |    |     |
| Verification | Statis | tics mi | ssing for wa | rning | nun | ber  | 8    | ,   | ,   | ,   | ,  | ,   | ,  | ,    | ,   | ,   | ,   | , . |    | ,   |

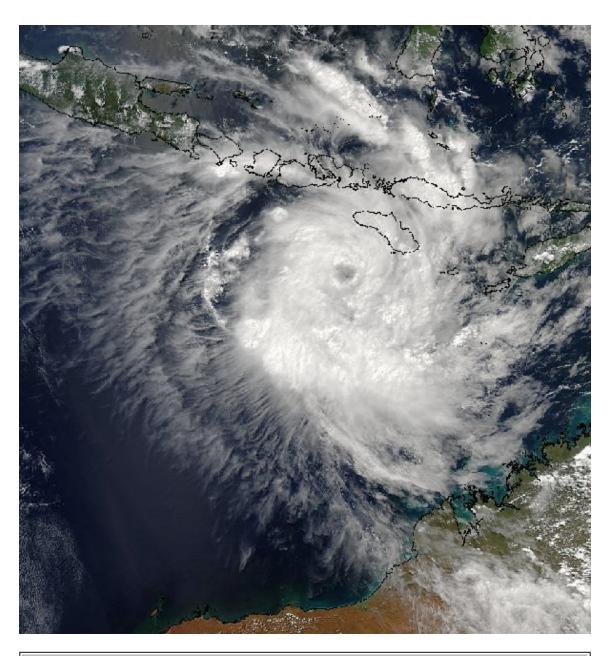


Figure 2-26S-1. 020555Z April 2003 MODIS true-color image of TC 26S (Inigo), located 440nm west-northwest of Port Warrender, Australia, with an intensity of 45 knots as it began a phase of rapid intensification.

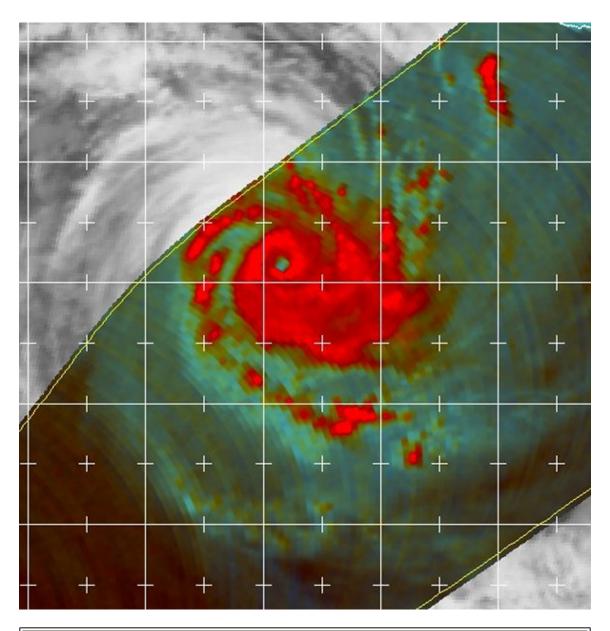


Figure 2-26S-2. 041531Z April 2003 color composite TRMM image of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

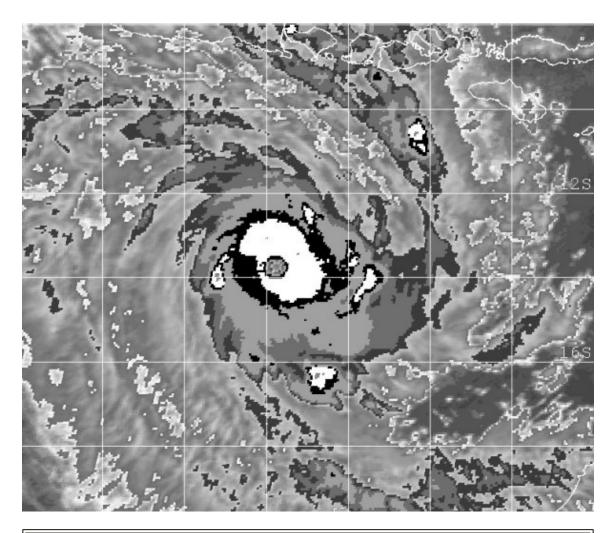
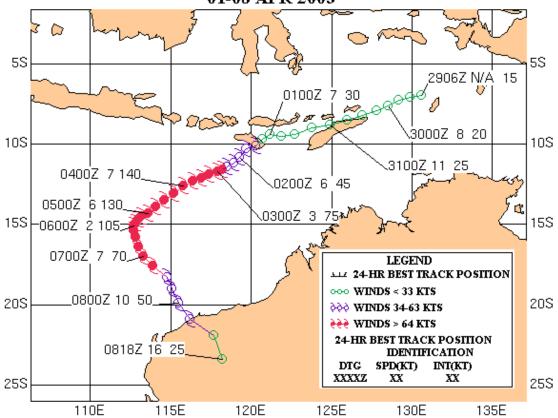
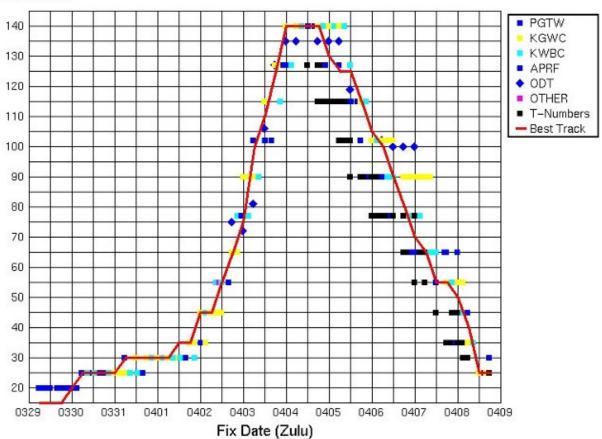


Figure 2-26S-3. 041531Z April 2003 enhanced infrared imagery of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

#### TROPICAL CYCLONE 26P (INIGO) 01-08 APR 2003



## Time Intensity for 26S



# Tropical Cyclone (TC) 27P (Fili)\*



First Poor: 0230Z 12 Apr 03

First Fair: 1630Z 13 Apr 03

First TCFA: 2330Z 13 Apr 03

First Warning: 0600Z 14 Apr 03

Last Warning: 0600Z 14 Apr 03, Extratropical

Max Intensity: 45 kts, gusts to 55 kts

Landfall: None

Total Warnings: 1

Remarks: None

|          |     |        | S      | tatist | ics | for | JTW   | /C c | on T | C2 | 7P |     |     |      |     |     |   |    |    |     |
|----------|-----|--------|--------|--------|-----|-----|-------|------|------|----|----|-----|-----|------|-----|-----|---|----|----|-----|
|          | WRN | BEST T | RACK   |        | РО  | SIT | ION E | ERR  | OR   | S  |    |     | WII | ND I | ERF | ROR | S |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind   | 00  |     | 24    | 36   |      |    | 96 | 120 |     |      | 24  |     |   | 72 | 96 | 120 |
| 03041300 |     | 13.5S  | 179.6W | 20     |     |     |       |      |      |    |    |     |     |      |     |     |   |    |    |     |
| 03041306 |     | 13.8S  | 179.3W | 25     |     |     |       |      |      |    |    |     |     |      |     |     |   |    |    |     |
| 03041312 |     | 14.2S  | 178.9W | 25     |     |     |       |      |      |    |    |     |     |      |     |     |   |    |    |     |
| 03041318 |     | 14.6S  | 178.2W | 30     |     |     |       |      |      |    |    |     |     |      |     |     |   |    |    |     |

| 03041400 |   | 15.3S | 177.0W  | 30 |    |    |     |  |  |   |     |    |  |  |  |
|----------|---|-------|---------|----|----|----|-----|--|--|---|-----|----|--|--|--|
|          | 1 |       |         |    | 10 | 00 | 246 |  |  | 0 | 4.5 | 20 |  |  |  |
| 03041406 | I | 16.0S | 175.7W  | 35 | 18 | 80 | 246 |  |  | 0 | 15  | 30 |  |  |  |
| 03041412 |   | 17.6S | 174.0W  | 35 |    |    |     |  |  |   |     |    |  |  |  |
| 03041418 |   | 20.2S | 172.2W  | 40 |    |    |     |  |  |   |     |    |  |  |  |
| 03041500 |   | 24.4S | 170.6W  | 45 |    |    |     |  |  |   |     |    |  |  |  |
| 03041506 |   | 29.3S | 169.7W  | 35 |    |    |     |  |  |   |     |    |  |  |  |
|          |   |       | AVERAGE |    | 18 | 80 | 246 |  |  | 0 | 15  | 30 |  |  |  |
|          |   |       | BIAS    |    |    |    |     |  |  | 0 | 15  | 30 |  |  |  |
|          |   |       | # CASES |    | 1  | 1  | 1   |  |  | 1 | 1   | 1  |  |  |  |

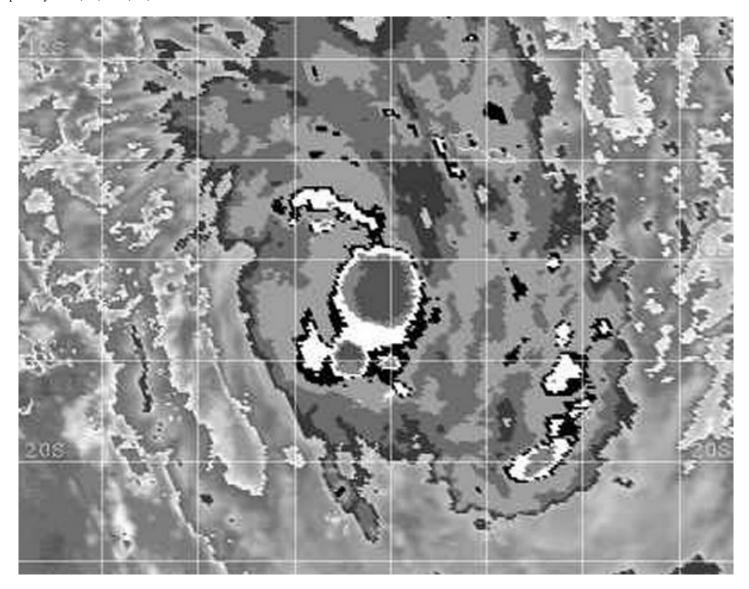


Figure 2-27P-1. 140531Z April 2003 enhanced infrared satellite image of TC 27P (Fili), 625 nm southeast of Suva, Fiji, with an intensity of 35 knots.

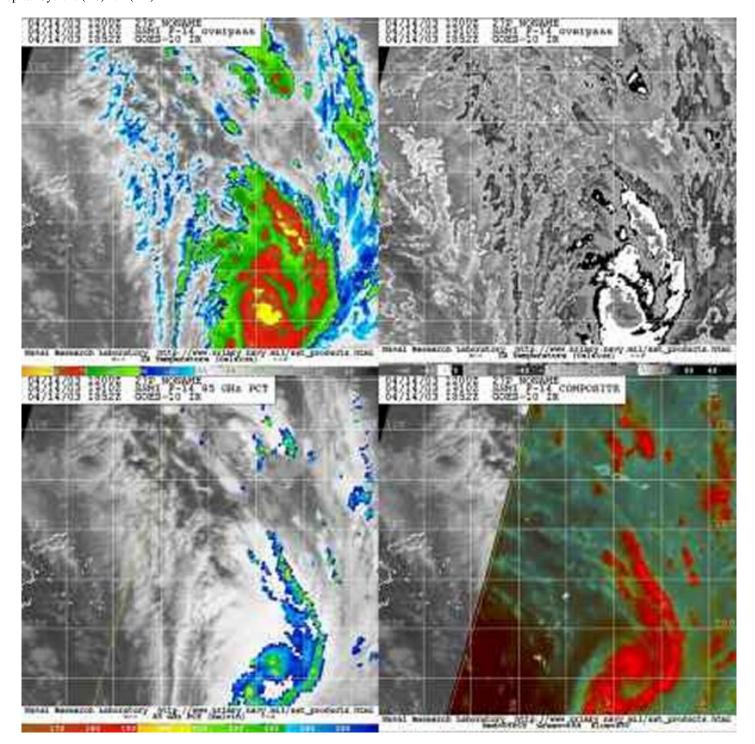
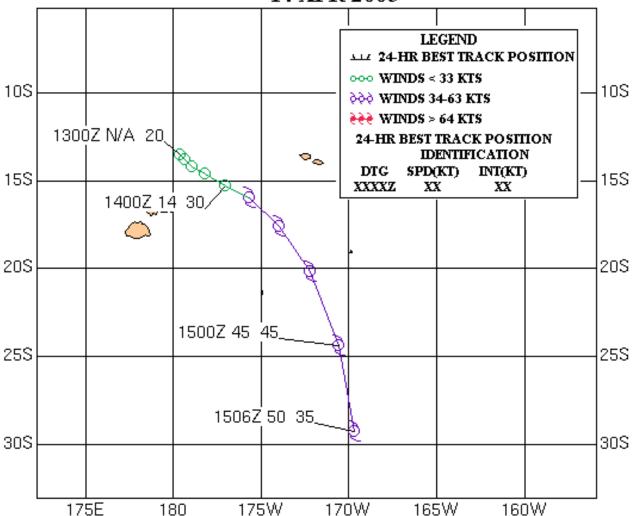
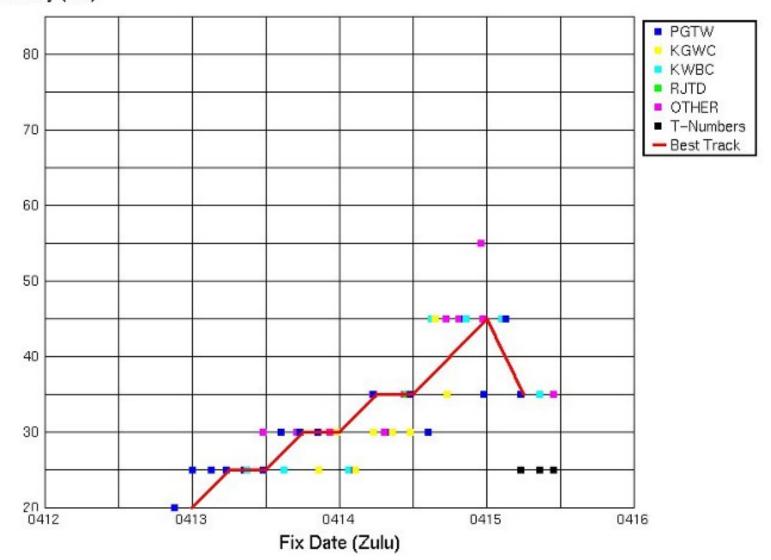


Figure 2-27P-2. 141910Z April 2003 multi-sensor satellite images of TC 27P (Fili), 575 nm southeast of Suva, Fiji, with an intensity of 35 knots.

### TROPICAL CYCLONE 27P (FILI) 14 APR 2003



# Time Intensity for 27P



# **Tropical Cyclone (TC) 27P (Fili)\***



First Poor: 0230Z 12 Apr 03

First Fair : 1630Z 13 Apr 03

First TCFA: 2330Z 13 Apr 03

First Warning: 0600Z 14 Apr 03

Last Warning: 0600Z 14 Apr 03, Extratropical

Max Intensity: 45 kts, gusts to 55 kts

Landfall : None

Total Warnings: 1

Remarks: None

|          |     |        | S      | tatisti | ics | for  | JTW   | C c | n T | C2       | 7P |     |       |      |     |       |    |    |    |     |
|----------|-----|--------|--------|---------|-----|------|-------|-----|-----|----------|----|-----|-------|------|-----|-------|----|----|----|-----|
|          | WDN | BEST T | -DVCK  |         | PO  | QIT. | ION E | DD  | ΩĐ  | <u> </u> |    |     | 14/11 | ND I | EDE | ) ( D | 0  |    |    |     |
|          |     | _      | -      |         |     |      |       |     |     |          |    |     |       |      |     | _     | _  |    |    |     |
| DTG      | NO. | LAT    | LONG   | wind    | 00  | 12   | 24    | 36  | 48  | 72       | 96 | 120 | 00    | 12   | 24  | 36    | 48 | 72 | 96 | 120 |
| 03041300 |     | 13.5S  | 179.6W | 20      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |
| 03041306 |     | 13.8S  | 179.3W | 25      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |
| 03041312 |     | 14.2S  | 178.9W | 25      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |
| 03041318 |     | 14.6S  | 178.2W | 30      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |
| 03041400 |     | 15.3S  | 177.0W | 30      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |
| 03041406 | 1   | 16.0S  | 175.7W | 35      | 18  | 80   | 246   |     |     |          |    |     | 0     | 15   | 30  |       |    |    |    |     |
| 03041412 |     | 17.6S  | 174.0W | 35      |     |      |       |     |     |          |    |     |       |      |     |       |    |    |    |     |

| 03041418 | 20.2S | 172.2W  | 40 |    |    |     |  |  |   |    |    |  |  |  |
|----------|-------|---------|----|----|----|-----|--|--|---|----|----|--|--|--|
| 03041500 | 24.4S | 170.6W  | 45 |    |    |     |  |  |   |    |    |  |  |  |
| 03041506 | 29.3S | 169.7W  | 35 |    |    |     |  |  |   |    |    |  |  |  |
|          |       | AVERAGE |    | 18 | 80 | 246 |  |  | 0 | 15 | 30 |  |  |  |
|          |       | BIAS    |    |    |    |     |  |  | 0 | 15 | 30 |  |  |  |
|          |       | # CASES |    | 1  | 1  | 1   |  |  | 1 | 1  | 1  |  |  |  |

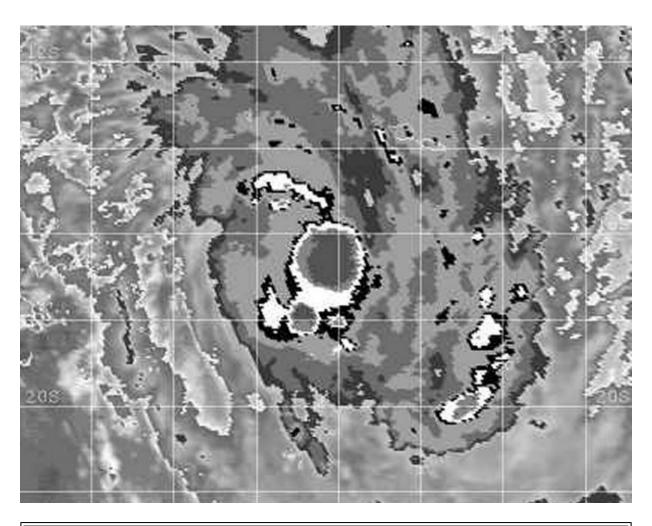


Figure 2-27P-1. 140531Z April 2003 enhanced infrared satellite image of TC 27P (Fili), 625 nm southeast of Suva, Fiji, with an intensity of 35 knots.

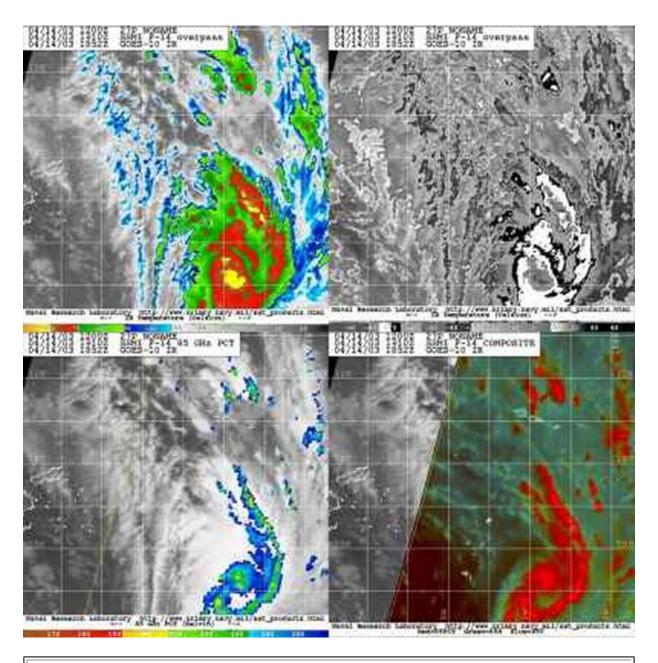
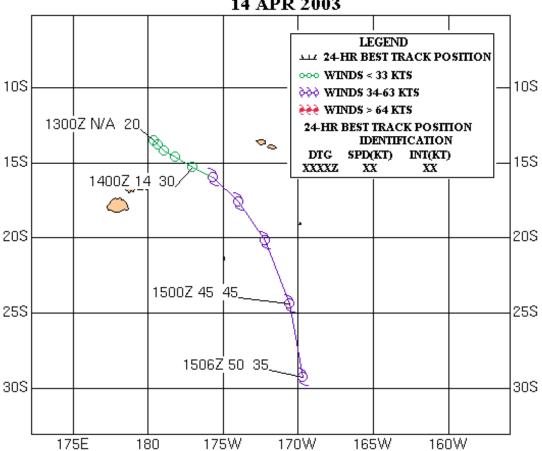
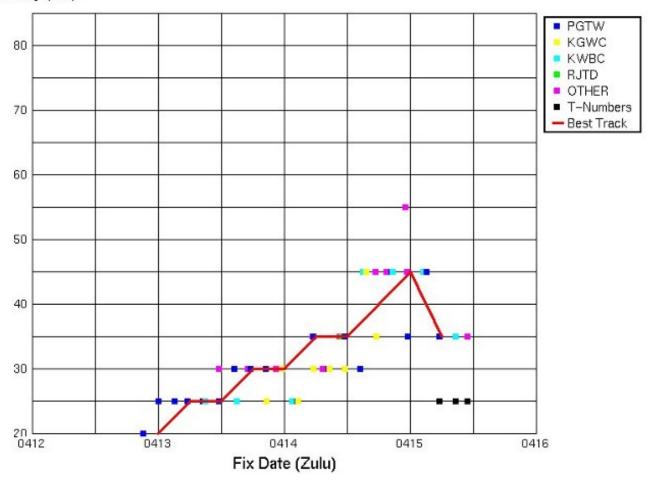


Figure 2-27P-2. 141910Z April 2003 multi-sensor satellite images of TC 27P (Fili), 575 nm southeast of Suva, Fiji, with an intensity of 35 knots.

### TROPICAL CYCLONE 27P (FILI) 14 APR 2003



# Time Intensity for 27P



## Tropical Cyclone (TC) 28S (Manou)\*



First Poor: 1800Z 28 Apr 03

First Fair: 1400Z 01 May 03

First TCFA: 0400Z 03 May 03

First Warning: 1200Z 03 May 03

Last Warning: 1800Z 10 May 03, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: None

Total Warnings: 15 plus 1 Amended Warning

Remarks:

(1) Tropical cyclone (TC) 28S developed approximately 240 nm southwest of Diego Garcia on 28 April, 2003 and cyclone intensified slowly during the first 48 hours after the initial warning. It peaked at 45 knots, then weakened to 35 knots around 0000Z on 06 May. TC 28S then slowly tracked southwestward, toward Madagascar, and reached a maximum intensity of 75 knots and maintained this intensity for 24 hours as it approached the mountainous coastline. It slowed drastically as it approached Madagascar and then turned poleward.

While it did not make landfall, TC 28S spent more than 12 hours within a few miles of the coast of Madagascar as it moved slowly southward along the coast at intensities from 65 to 75 knots. TC 28S finally dissipated over open water and the last warning was issued at 1800Z on 10 May, 2003.

(2) Reports indicated that there were 70 fatalities, 19 persons were missing, and 85 were injured. Further reports indicated 24,500 homes were destroyed, leaving 47,500 people homeless, with damage to infrastructure on Madagascar as a result of this cyclone.

|          |     |       |         | Stati | stic | s f | or J | ΓWC | on  | TC | 28S |     |    |      |     |     |          |    |    |     |
|----------|-----|-------|---------|-------|------|-----|------|-----|-----|----|-----|-----|----|------|-----|-----|----------|----|----|-----|
|          |     |       |         |       |      |     |      |     |     |    |     |     | 1  |      |     |     |          |    |    |     |
|          | WRN | BEST  | TRACK   |       | PO   | SIT | ION  | ERR | ORS | ,  |     |     | WI | ND E | ERR | ORS | <b>3</b> |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12  | 24   | 36  | 48  | 72 | 96  | 120 | 00 | 12   | 24  | 36  | 48       | 72 | 96 | 120 |
| 03050200 |     | 11.0S | 65.7E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050206 |     | 11.1S | 65.3E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050212 |     | 11.3S | 65.0E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050218 |     | 11.6S | 64.7E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050300 |     | 12.1S | 64.4E   | 25    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050306 |     | 12.8S | 64.0E   | 30    |      |     |      |     |     |    |     |     |    |      |     |     |          |    |    |     |
| 03050312 | 1   | 13.7S | 63.4E   | 35    | 25   | 61  | 55   | 74  | 108 |    |     |     | 0  | 0    | 15  | 30  | 45       |    |    |     |
| 03050400 | 2   | 15.0S | 61.8E   | 45    | 25   | 63  | 111  | 127 | 156 |    |     |     | 5  | 15   | 25  | 40  | 60       |    |    |     |
| 03050412 | 3   | 15.6S | 60.7E   | 45    | 0    | 26  | 55   | 73  | 129 |    |     |     | 0  | 10   | 25  | 40  | 50       |    |    |     |
| 03050500 | 4   | 16.1S | 59.4E   | 45    | 33   | 50  | 82   | 95  | 137 |    |     |     | 0  | 15   | 30  | 35  | 40       |    |    |     |
| 03050512 | 5   | 16.2S | 58.1E   | 40    | 17   | 32  | 69   | 123 | 174 |    |     |     | 0  | 5    | 0   | 0   | -10      |    |    |     |
| 03050600 | 6   | 16.8S | 56.9E   | 35    | 0    | 21  | 48   | 85  | 118 |    |     |     | 0  | 0    | 0   | -10 | -20      |    |    |     |
| 03050612 | 7   | 17.5S | 55.2E   | 35    | 18   | 55  |      |     |     |    |     |     | -5 | -10  |     |     |          |    |    |     |
| 03050618 | 7A  | 17.9S | 54.3E   | 35    | 5    | 27  | 60   | 92  | 103 |    |     |     | 5  | -5   | -20 | -30 | -40      |    |    |     |
| 03050706 | 8   | 18.3S | 52.6E   | 45    | 11   | 21  | 38   | 28  | 94  |    |     |     | 0  | -5   | -15 | -35 | -50      |    |    |     |
| 03050718 | 9   | 18.7S | 51.2E   | 55    | 5    | 34  | 23   | 8   | 54  |    |     |     | 0  | -5   | -20 | -25 | -25      |    |    |     |
| 03050806 | 10  | 19.1S | 49.8E   | 65    | 5    | 49  | 82   | 81  | 66  |    |     |     | 0  | 0    | -30 | -5  | 20       |    |    |     |
| 03050818 | 11  | 19.3S | 49.2E   | 75    | 0    | 34  | 72   | 93  | 123 |    |     |     | 0  | -15  | -10 | 20  | 35       |    |    |     |
| 03050906 | 12  | 19.5S | 49.0E   | 75    | 0    | 13  | 13   | 90  |     |    |     |     | 0  | 10   | 35  | 45  |          |    |    |     |
| 03050918 | 13  | 20.0S | 48.9E   | 60    | 5    | 31  | 102  |     |     |    |     |     | -5 | 0    | 20  |     |          |    |    |     |
| 03051006 | 14  | 21.0S | 48.9E   | 40    | 12   | 23  |      |     |     |    |     |     | 0  | 5    |     |     |          |    |    |     |
| 03051018 | 15  | 22.9S | 48.9E   | 30    | 26   |     |      |     |     |    |     |     | 0  |      |     |     |          |    |    |     |
|          |     |       | AVERAGE |       | 12   | 36  | 62   | 81  | 115 |    |     |     | 1  | 7    | 19  | 26  | 36       |    |    |     |
|          |     |       | BIAS    |       |      |     |      |     |     |    |     |     | 0  | 1    | 4   | 9   | 10       |    |    |     |
|          |     |       | # CASES |       | 16   | 15  | 13   | 12  | 11  |    |     |     | 16 | 15   | 13  | 12  | 11       |    |    |     |

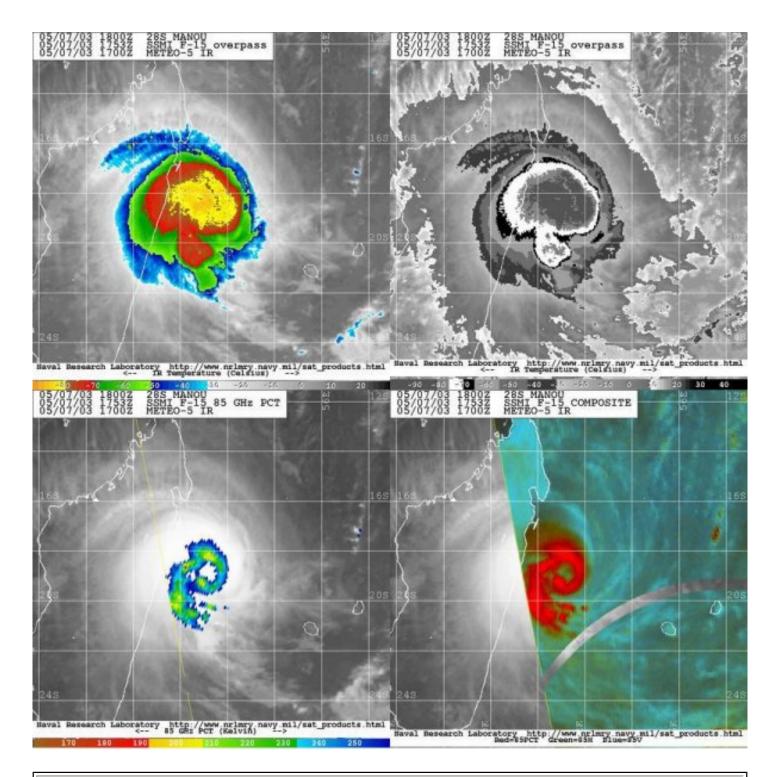


Figure 2-28S-1. 071753Z May 2003 multi-sensor satellite images of TC 28S (Manou), located off the east coast of Madagascar, with a maximum intensity of 75 knots.

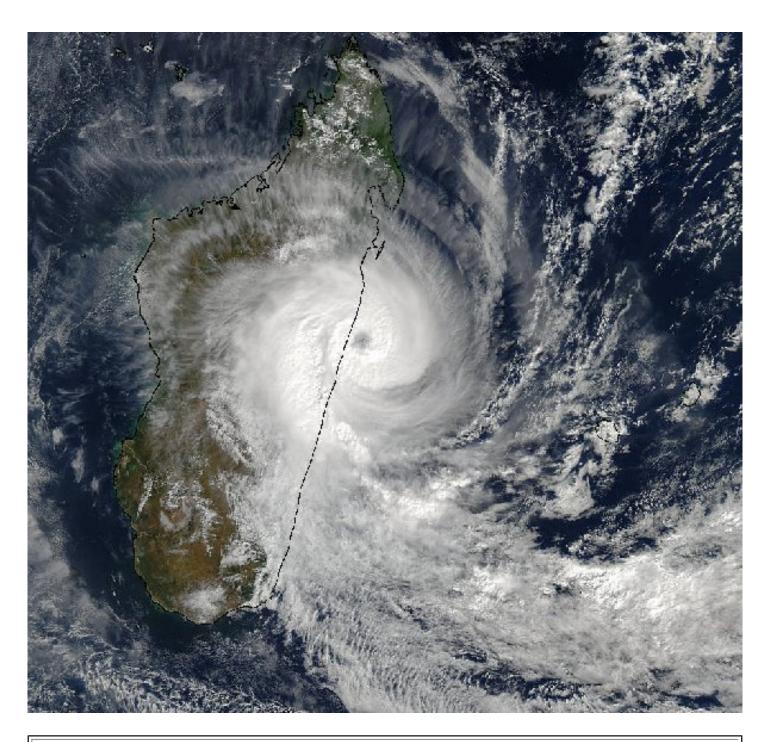
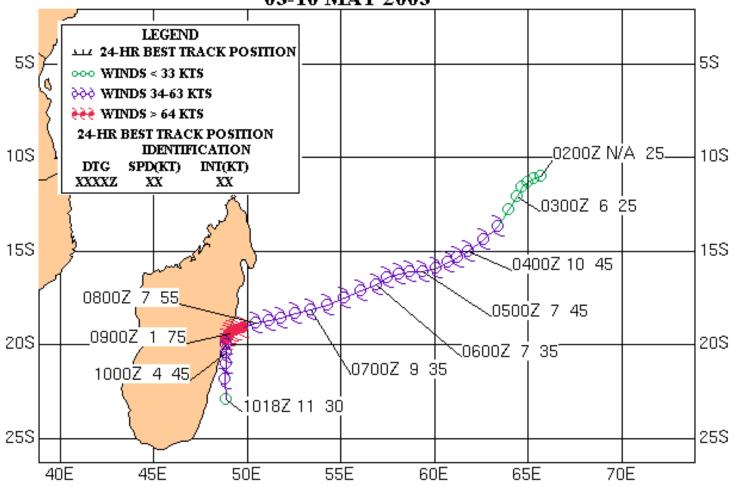
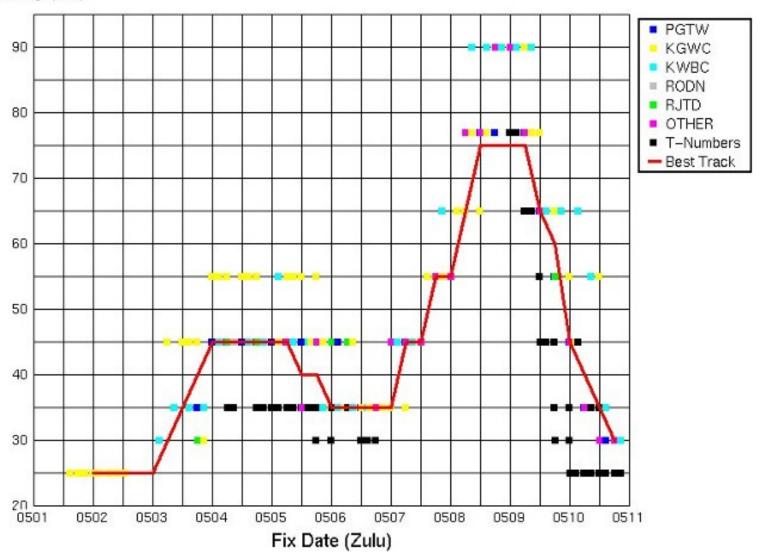


Figure 2-28S-2. 081020Z May 2003 MODIS true-color image of TC 28S (Manou), located off the coast of Madagascar, with a maximum intensity of 75 knots.





# Time Intensity for 28S



## Tropical Cyclone (TC) 28S (Manou)\*



First Poor : 1800Z 28 Apr 03

First Fair : 1400Z 01 May 03

First TCFA: 0400Z 03 May 03

First Warning: 1200Z 03 May 03

Last Warning: 1800Z 10 May 03, Dissipated

Max Intensity: 75 kts, gusts to 90 kts

Landfall: None

Total Warnings: 15 plus 1 Amended Warning

Remarks:

(1) Tropical cyclone (TC) 28S developed approximately 240 nm southwest of Diego Garcia on 28 April, 2003 and cyclone intensified slowly during the first 48 hours after the initial warning. It peaked at 45 knots, then weakened to 35 knots around 0000Z on 06 May. TC 28S then slowly tracked southwestward, toward Madagascar, and reached a maximum intensity of 75 knots and maintained this intensity for 24 hours as it approached the mountainous coastline. It slowed drastically as it approached Madagascar and then turned poleward.

While it did not make landfall, TC 28S spent more than 12 hours within a few miles of the coast of Madagascar as it moved slowly southward along the coast at intensities from 65 to 75 knots. TC 28S finally dissipated over open water and the last warning was issued at 1800Z on 10 May, 2003.

(2) Reports indicated that there were 70 fatalities, 19 persons were missing, and 85 were injured. Further reports indicated 24,500 homes were destroyed, leaving 47,500 people homeless, with damage to infrastructure on Madagascar as a result of this cyclone.

#### Statistics for JTWC on TC28S

|          | WRN | BEST  | ΓRACK   |      | PO | SIT | ION | ERR | ORS |    |    |     | WII | ND E | ERR | ORS | ;   |    |    |     |
|----------|-----|-------|---------|------|----|-----|-----|-----|-----|----|----|-----|-----|------|-----|-----|-----|----|----|-----|
| DTG      | NO. | LAT   | LONG    | wind | 00 | 12  | 24  | 36  | 48  | 72 | 96 | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03050200 |     | 11.0S | 65.7E   | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050206 |     | 11.1S | 65.3E   | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050212 |     | 11.3S | 65.0E   | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050218 |     | 11.6S | 64.7E   | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050300 |     | 12.1S | 64.4E   | 25   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050306 |     | 12.8S | 64.0E   | 30   |    |     |     |     |     |    |    |     |     |      |     |     |     |    |    |     |
| 03050312 | 1   | 13.7S | 63.4E   | 35   | 25 | 61  | 55  | 74  | 108 |    |    |     | 0   | 0    | 15  | 30  | 45  |    |    |     |
| 03050400 | 2   | 15.0S | 61.8E   | 45   | 25 | 63  | 111 | 127 | 156 |    |    |     | 5   | 15   | 25  | 40  | 60  |    |    |     |
| 03050412 | 3   | 15.6S | 60.7E   | 45   | 0  | 26  | 55  | 73  | 129 |    |    |     | 0   | 10   | 25  | 40  | 50  |    |    |     |
| 03050500 | 4   | 16.1S | 59.4E   | 45   | 33 | 50  | 82  | 95  | 137 |    |    |     | 0   | 15   | 30  | 35  | 40  |    |    |     |
| 03050512 | 5   | 16.2S | 58.1E   | 40   | 17 | 32  | 69  | 123 | 174 |    |    |     | 0   | 5    | 0   | 0   | -10 |    |    |     |
| 03050600 | 6   | 16.8S | 56.9E   | 35   | 0  | 21  | 48  | 85  | 118 |    |    |     | 0   | 0    | 0   | -10 | -20 |    |    |     |
| 03050612 | 7   | 17.5S | 55.2E   | 35   | 18 | 55  |     |     |     |    |    |     | -5  | -10  |     |     |     |    |    |     |
| 03050618 | 7A  | 17.9S | 54.3E   | 35   | 5  | 27  | 60  | 92  | 103 |    |    |     | 5   | -5   | -20 | -30 | -40 |    |    |     |
| 03050706 | 8   | 18.3S | 52.6E   | 45   | 11 | 21  | 38  | 28  | 94  |    |    |     | 0   | -5   | -15 | -35 | -50 |    |    |     |
| 03050718 | 9   | 18.7S | 51.2E   | 55   | 5  | 34  | 23  | 8   | 54  |    |    |     | 0   | -5   | -20 | -25 | -25 |    |    |     |
| 03050806 | 10  | 19.1S | 49.8E   | 65   | 5  | 49  | 82  | 81  | 66  |    |    |     | 0   | 0    | -30 | -5  | 20  |    |    |     |
| 03050818 | 11  | 19.3S | 49.2E   | 75   | 0  | 34  | 72  | 93  | 123 |    |    |     | 0   | -15  | -10 | 20  | 35  |    |    |     |
| 03050906 | 12  | 19.5S | 49.0E   | 75   | 0  | 13  | 13  | 90  |     |    |    |     | 0   | 10   | 35  | 45  |     |    |    |     |
| 03050918 | 13  | 20.0S | 48.9E   | 60   | 5  | 31  | 102 |     |     |    |    |     | -5  | 0    | 20  |     |     |    |    |     |
| 03051006 | 14  | 21.0S | 48.9E   | 40   | 12 | 23  |     |     |     |    |    |     | 0   | 5    |     |     |     |    |    |     |
| 03051018 | 15  | 22.9S | 48.9E   | 30   | 26 |     |     |     |     |    |    |     | 0   |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |      | 12 | 36  | 62  | 81  | 115 |    |    |     | 1   | 7    | 19  | 26  | 36  |    |    |     |
|          |     |       | BIAS    |      |    |     |     |     |     |    |    |     | 0   | 1    | 4   | 9   | 10  |    |    |     |
|          |     |       | # CASES |      | 16 | 15  | 13  | 12  | 11  |    |    |     | 16  | 15   | 13  | 12  | 11  |    |    |     |

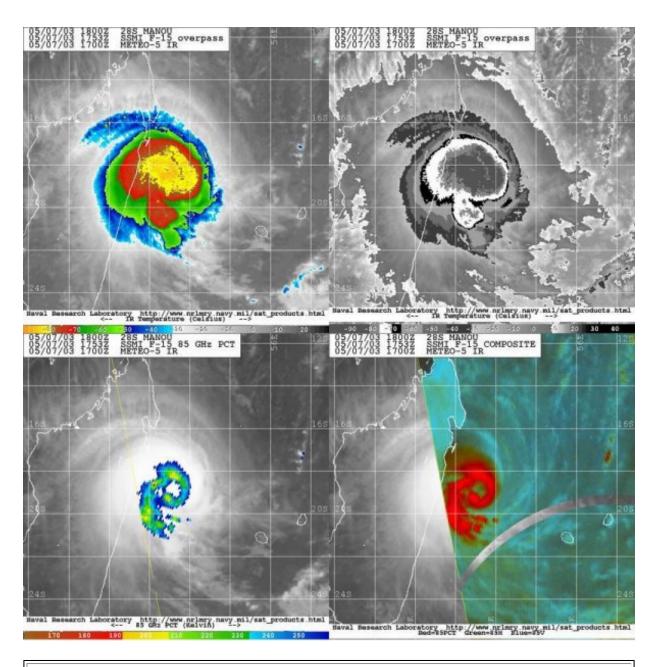


Figure 2-28S-1. 071753Z May 2003 multi-sensor satellite images of TC 28S (Manou), located off the east coast of Madagascar, with a maximum intensity of 75 knots.

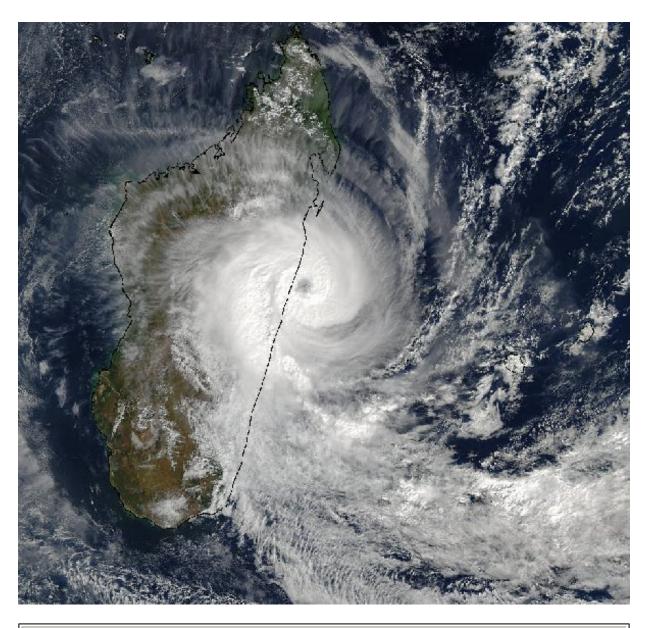
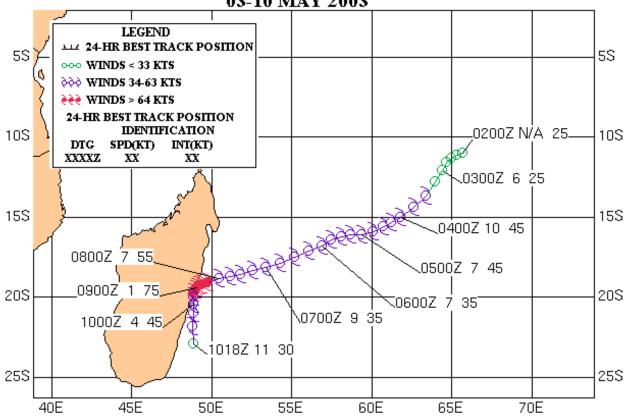
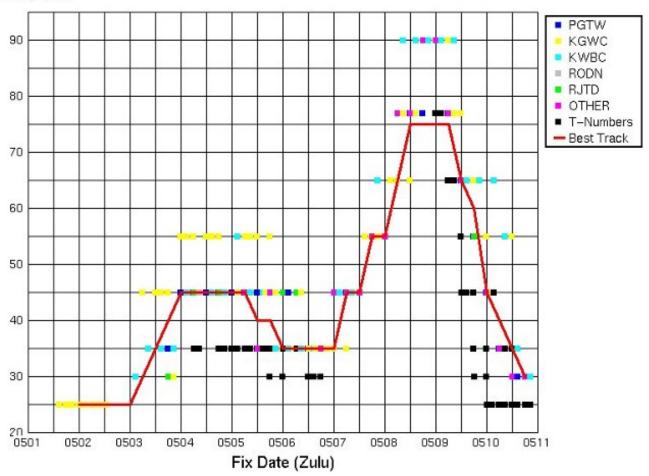


Figure 2-28S-2. 081020Z May 2003 MODIS true-color image of TC 28S (Manou), located off the coast of Madagascar, with a maximum intensity of 75 knots.

#### TROPICAL CYCLONE 28S (MANOU) 03-10 MAY 2003



## Time Intensity for 28S



## **Tropical Cyclone (TC) 29P (Gina)\***



First Poor: N/A

First Fair: 2300Z 03 Jun 03

First TCFA: 0200Z 04 Jun 03

First Warning: 1800Z 04 Jun 03

Last Warning: 1800Z 08 Jun 03, Extratropical

Max Intensity: 90 kts, gusts to 110 kts

Landfall: None

Total Warnings: 9 plus 1 amended

Remarks:

(1) Tropical Cyclone (TC) 29P was first noted as a tropical disturbance east of the Solomon Islands on 03 June, 2003 and described as a partially exposed low level circulation center associated with rapidly organizing deep convection. A Tropical Cyclone Formation Alert was issued within a few hours based on the rapid organization of the tropical cyclone, with the cyclone gaining warning status by 1800Z on 04 June.

TC 29P tracked southwestward under the influence of a low to mid-level steering ridge to the east for approximately 72 hours after the initial warning. Intensification was near the climatological average for most of this period, reaching a maximum intensity of 90 knots around 1200z on 07 June. Afterwards, an approaching shortwave trough created a weakness in the ridge, causing a sharp recurvature and extratropical transition.

(2) No reports of damages were received for this system.

|          |     |       |         | Stati | stic                           | cs f | or J | TWC | on  | TC | 29F | _   |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|--------------------------------|------|------|-----|-----|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |                                |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PC                             | SIT  | ION  | ERR | ORS |    |     |     | WIN | ID E | RRC | DRS |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00                             | 12   | 24   | 36  | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03060400 |     | 10.0S | 171.7E  | 25    |                                |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060406 |     | 10.1S | 171.1E  | 30    |                                |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060412 |     | 10.3S | 170.5E  | 30    |                                |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060418 | 1   | 10.6S | 169.9E  | 30    |                                |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060506 | 2   | 11.7S | 168.8E  | 45    | 5 17 43 95 168 201 0 0 15 5 -5 |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060518 | 3   | 13.0S | 167.7E  | 55    | 0                              | 33   | 55   | 76  | 100 |    |     |     | 0   | 10   | 10  | 0   | 5   |    |    |     |
| 03060606 | 4   | 14.4S | 166.1E  | 55    | 13                             | 53   | 66   | 96  | 58  |    |     |     | 0   | 0    | -30 | -50 | -40 |    |    |     |
| 03060618 | 5   | 15.3S | 164.0E  | 65    | 29                             | 41   | 71   | 140 | 228 |    |     |     | 0   | -25  | -45 | -35 | -20 |    |    |     |
| 03060700 | 5A  | 15.7S | 163.1E  | 75    | 0                              | 33   | 70   | 131 |     |    |     |     | -10 | 0    | 15  | 25  |     |    |    |     |
| 03060712 | 6   | 16.8S | 162.1E  | 90    | 0                              | 24   | 121  |     |     |    |     |     | 0   | 0    | 25  |     |     |    |    |     |
| 03060800 | 7   | 17.6S | 161.9E  | 90    | 13                             | 71   |      |     |     |    |     |     | 0   | 20   |     |     |     |    |    |     |
| 03060812 | 8   | 18.3S | 163.3E  | 65    | 0                              |      |      |     |     |    |     |     | 0   |      |     |     |     |    |    |     |
| 03060818 | 9   | 18.7S | 165.0E  | 55    | 0                              |      |      |     |     |    |     |     | -15 |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 9                              | 41   | 79   | 122 | 148 |    |     |     | 3   | 8    | 23  | 22  | 19  |    |    |     |
|          |     |       | BIAS    |       |                                |      |      |     |     |    |     |     | -3  | -1   | -4  | -12 | -17 |    |    |     |
|          |     |       | # CASES |       | 10                             | 8    | 7    | 6   | 5   |    |     |     | 10  | 8    | 7   | 6   | 5   |    |    |     |

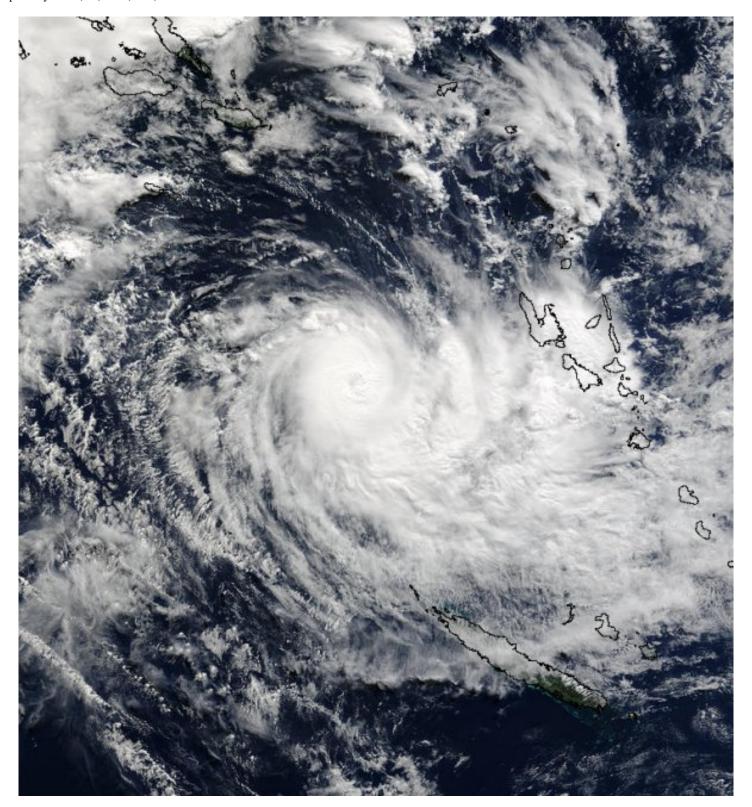


Figure 2-28P-1. 062340Z June 2003 MODIS true-color image of TC 29P (Gina), located northwest of New Caledonia, with an intensity of 65 knots.

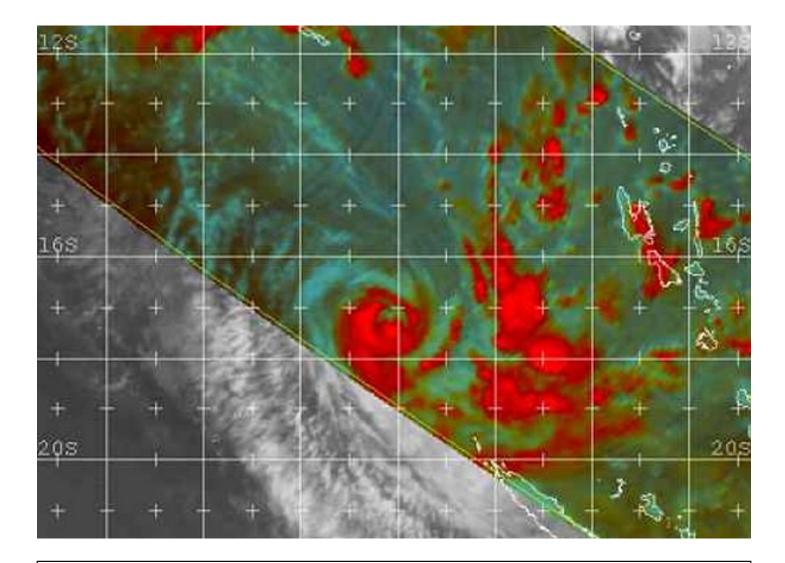
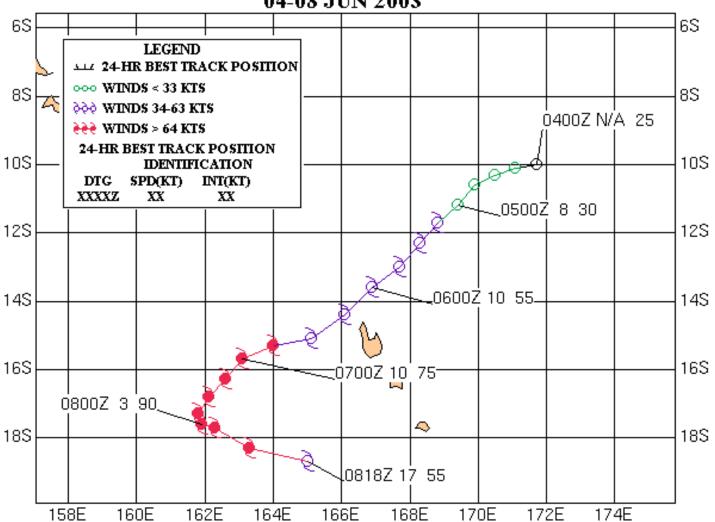
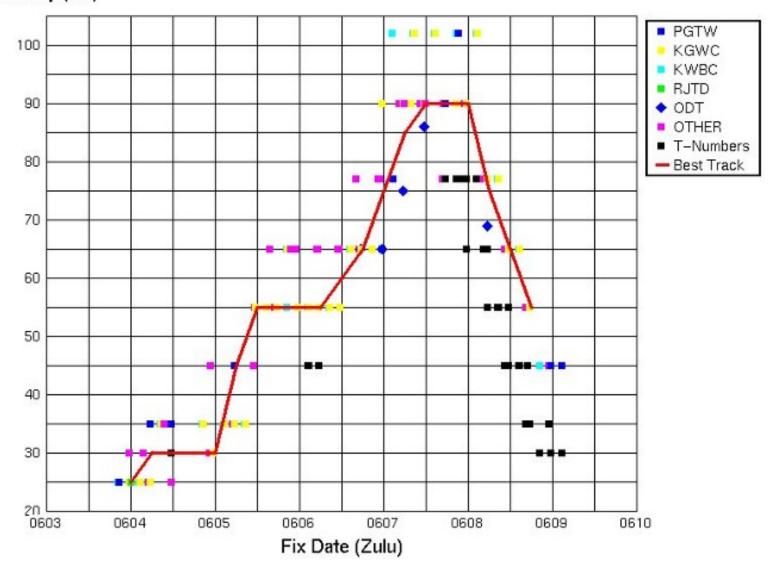


Figure 2-29P-2. 071849Z June 2003 TRMM color composite image of TC 29P (Gina), located 320 nm west of Vila, with an estimated intensity of 90 knots.

#### TROPICAL CYCLONE 29S (GINA) 04-08 JUN 2003



# Time Intensity for 29P



## Tropical Cyclone (TC) 29S (Gina)\*



First Poor : N/A

First Fair: 2300Z 03 Jun 03

First TCFA: 0200Z 04 Jun 03

First Warning: 1800Z 04 Jun 03

Last Warning: 1800Z 08 Jun 03, Extratropical

Max Intensity: 90 kts, gusts to 110 kts

Landfall: None

Total Warnings: 9 plus 1 amended

Remarks:

(1) Tropical Cyclone (TC) 29P was first noted as a tropical disturbance east of the Solomon Islands on 03 June, 2003 and described as a partially exposed low level circulation center associated with rapidly organizing deep convection. A Tropical Cyclone Formation Alert was issued within a few hours based on the rapid organization of the tropical cyclone, with the cyclone gaining warning status by 1800Z on 04 June.

TC 29P tracked southwestward under the influence of a low to mid-level steering ridge to the east for approximately 72 hours after the initial warning. Intensification was near the climatological average for most of this period, reaching a maximum intensity of 90 knots around 1200z on 07 June. Afterwards, an approaching shortwave trough created a weakness in the ridge, causing a sharp recurvature and extratropical transition.

(2) No reports of damages were received for this system.

|          |     |       |         | Stati | stic | cs f | or J | TWC | on  | тс | 29F | •   |     |      |     |     |     |    |    |     |
|----------|-----|-------|---------|-------|------|------|------|-----|-----|----|-----|-----|-----|------|-----|-----|-----|----|----|-----|
|          |     |       |         |       |      |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
|          | WRN | BEST  | TRACK   |       | PC   | SIT  | ION  | ERR | ORS |    |     |     | WIN | ID E | RRC | DRS |     |    |    |     |
| DTG      | NO. | LAT   | LONG    | wind  | 00   | 12   | 24   | 36  | 48  | 72 | 96  | 120 | 00  | 12   | 24  | 36  | 48  | 72 | 96 | 120 |
| 03060400 |     | 10.0S | 171.7E  | 25    |      |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060406 |     | 10.1S | 171.1E  | 30    |      |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060412 |     | 10.3S | 170.5E  | 30    |      |      |      |     |     |    |     |     |     |      |     |     |     |    |    |     |
| 03060418 | 1   | 10.6S | 169.9E  | 30    | 16   | 32   | 76   | 123 | 152 |    |     |     | 0   | -10  | -20 | -15 | -25 |    |    |     |
| 03060506 | 2   | 11.7S | 168.8E  | 45    | 17   | 43   | 95   | 168 | 201 |    |     |     | 0   | 0    | 15  | 5   | -5  |    |    |     |
| 03060518 | 3   | 13.0S | 167.7E  | 55    | 0    | 33   | 55   | 76  | 100 |    |     |     | 0   | 10   | 10  | 0   | 5   |    |    |     |
| 03060606 | 4   | 14.4S | 166.1E  | 55    | 13   | 53   | 66   | 96  | 58  |    |     |     | 0   | 0    | -30 | -50 | -40 |    |    |     |
| 03060618 | 5   | 15.3S | 164.0E  | 65    | 29   | 41   | 71   | 140 | 228 |    |     |     | 0   | -25  | -45 | -35 | -20 |    |    |     |
| 03060700 | 5A  | 15.7S | 163.1E  | 75    | 0    | 33   | 70   | 131 |     |    |     |     | -10 | 0    | 15  | 25  |     |    |    |     |
| 03060712 | 6   | 16.8S | 162.1E  | 90    | 0    | 24   | 121  |     |     |    |     |     | 0   | 0    | 25  |     |     |    |    |     |
| 03060800 | 7   | 17.6S | 161.9E  | 90    | 13   | 71   |      |     |     |    |     |     | 0   | 20   |     |     |     |    |    |     |
| 03060812 | 8   | 18.3S | 163.3E  | 65    | 0    |      |      |     |     |    |     |     | 0   |      |     |     |     |    |    |     |
| 03060818 | 9   | 18.7S | 165.0E  | 55    | 0    |      |      |     |     |    |     |     | -15 |      |     |     |     |    |    |     |
|          |     |       | AVERAGE |       | 9    | 41   | 79   | 122 | 148 |    |     |     | 3   | 8    | 23  | 22  | 19  |    |    |     |
|          |     |       | BIAS    |       |      |      |      |     |     |    |     |     | -3  | -1   | -4  | -12 | -17 |    |    |     |
|          |     |       | # CASES |       | 10   | 8    | 7    | 6   | 5   |    |     |     | 10  | 8    | 7   | 6   | 5   |    |    |     |

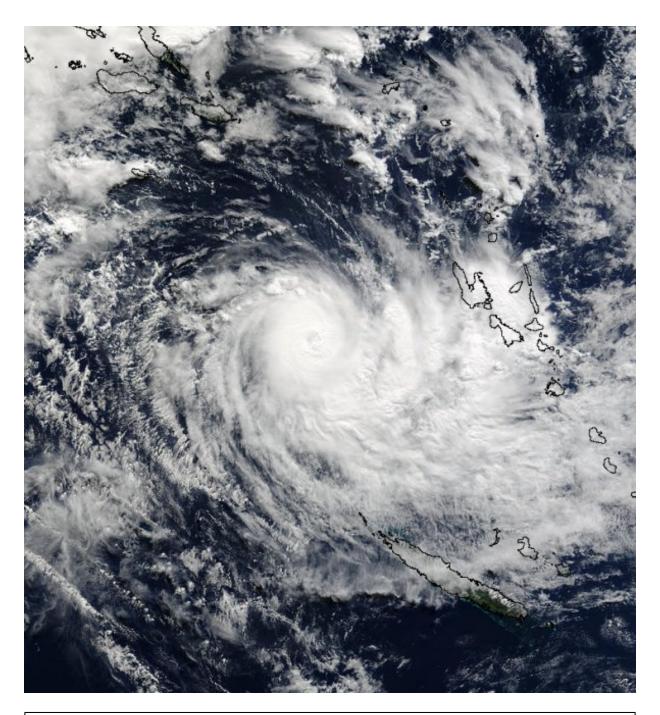


Figure 2-28P-1. 062340Z June 2003 MODIS true-color image of TC 29P (Gina), located northwest of New Caledonia, with an intensity of 65 knots.

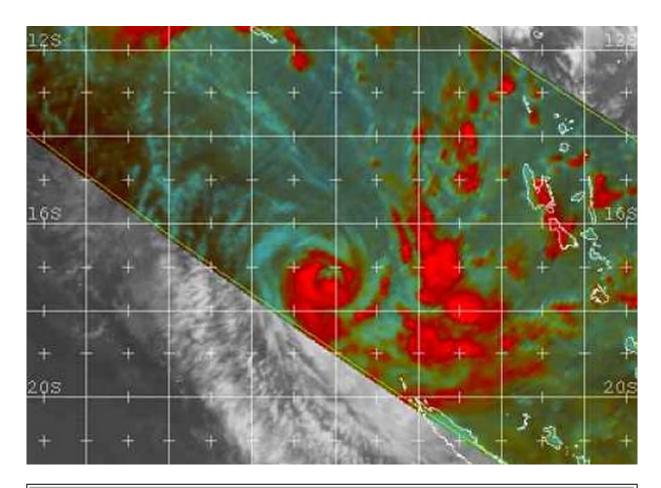
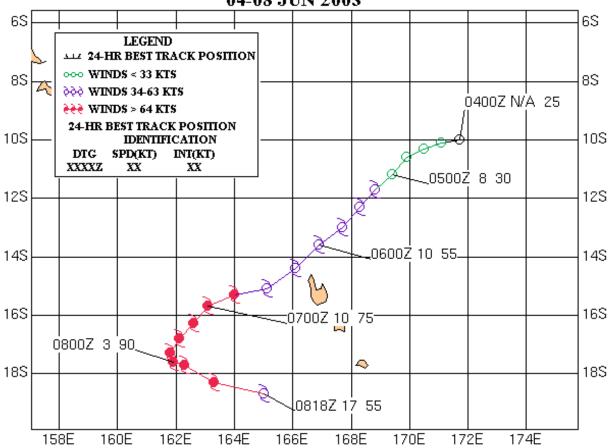
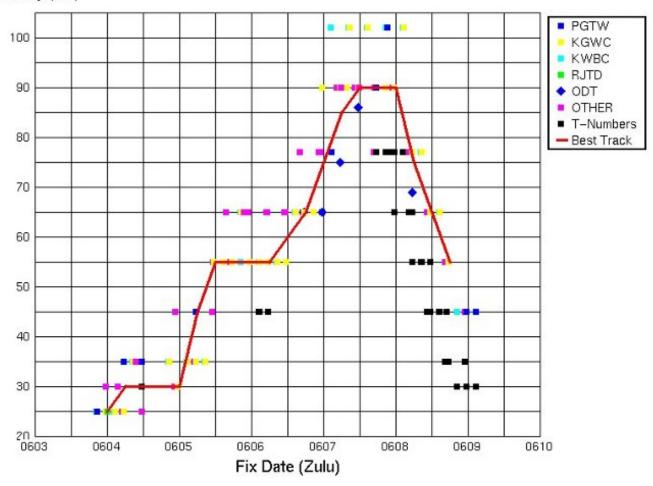


Figure 2-29P-2. 071849Z June 2003 TRMM color composite image of TC 29P (Gina), located 320 nm west of Vila, with an estimated intensity of 90 knots.

#### TROPICAL CYCLONE 29S (GINA) 04-08 JUN 2003



## Time Intensity for 29P



## 3. TROPICAL CYCLONE FIX DATA

# 3.1 2003 SEASON

Tables 3-1 to 3-3 list the number of tropical cyclone center "fixes", or locations, made using satellite (visible, infrared, and microwave), scatterometer, radar, and synoptic data. Fixes made by the DOD tropical cyclone reconnaissance network sites are included in the tables as well as those fixes received from other sources (e.g., Japanese Meteorological Agency, Australian Bureau of Meteorology, and U.S. National Weather Service National Environmental Satellite Data and Information Service).

|             |           |           | TABLE 3   | -1          |          |        |
|-------------|-----------|-----------|-----------|-------------|----------|--------|
| SOUTH       | PACIFIC 8 | SOUTH     | INDIAN OC | EAN FIX SUM | MARY FO  | R 2003 |
| Tropical Cy | vclone    | Satellite | Scatt     | Radar       | Synoptic | Total  |
| TC 01S      | -         | 51        | 0         | 0           | 0        | 51     |
| TC 02S      | Atang     | 180       | 3         | 0           | 0        | 183    |
| TC 03S      | Boura     | 214       | 8         | 0           | 0        | 222    |
| TC 04P      | Yolande   | 68        | 3         | 0           | 1        | 72     |
| TC 05S      | Crystal   | 179       | 6         | 0           | 0        | 185    |
| TC 06P      | Zoe       | 219       | 7         | 0           | 0        | 226    |
| TC 07S      | -         | 109       | 8         | 0           | 0        | 117    |
| TC 08S      | Delfina   | 119       | 1         | 0           | 0        | 120    |
| TC 09S      | Ebula     | 141       | 5         | 0           | 0        | 146    |
| TC 10P      | Ami       | 131       | 1         | 1           | 0        | 133    |
| TC 11S      | Fari      | 204       | 4         | 0           | 0        | 208    |

| _                   |         |      |     |      |     |      |
|---------------------|---------|------|-----|------|-----|------|
| TC 12P              | Beni    | 267  | 8   | 0    | 0   | 275  |
| TC 13P              | Cilla   | 110  | 5   | 0    | 0   | 115  |
| TC 14S              | Fiona   | 234  | 5   | 1    | 0   | 240  |
| TC 15P              | Dovi    | 203  | 7   | 0    | 0   | 210  |
| TC 16S              | Gerry   | 167  | 8   | 0    | 0   | 175  |
| TC 17S              | Наре    | 139  | 2   | 0    | 0   | 141  |
| TC 18S              | Isha    | 169  | 3   | 0    | 0   | 172  |
| TC 19S              | Japhet  | 184  | 0   | 0    | 0   | 184  |
| TC 20S              | Graham  | 56   | 2   | 0    | 2   | 60   |
| TC 21S              | Harriet | 170  | 9   | 0    | 0   | 179  |
| TC 22P              | Erica   | 223  | 6   | 0    | 0   | 229  |
| TC 23S              | Kalunde | 291  | 7   | 0    | 0   | 298  |
| TC 24S              | Craig   | 91   | 1   | 0    | 1   | 93   |
| TC 25P              | Eseta   | 121  | 2   | 0    | 0   | 123  |
| TC 26S              | Inigo   | 238  | 3   | 0    | 1   | 242  |
| TC 27P              | Fili    | 54   | 0   | 0    | 0   | 54   |
| TC 28S              | Manou   | 234  | 6   | 0    | 0   | 240  |
| TC 29P              | Gina    | 169  | 5   | 0    | 0   | 174  |
|                     | Totals  | 4735 | 125 | 2    | 5   | 4867 |
| Percentage of Total |         | 97.3 | 2.6 | 0.04 | 0.1 | 100  |

|            |          | TABLE 3-2 |           |              |              |       |  |  |  |  |  |  |  |  |
|------------|----------|-----------|-----------|--------------|--------------|-------|--|--|--|--|--|--|--|--|
|            | WESTERN  | NORTH P   | ACIFIC OC | CEAN FIX SUM | MARY FOR 200 | )3    |  |  |  |  |  |  |  |  |
| Tropical ( | Cyclone  | Satellite | Scatt     | Radar        | Synoptic     | Total |  |  |  |  |  |  |  |  |
| TS 01W     | Yanyan   | 213       | 3         | 12           | 0            | 228   |  |  |  |  |  |  |  |  |
| TY 02W     | Kujira   | 591       | 15        | 11           | 3            | 620   |  |  |  |  |  |  |  |  |
| TD 03W     | -        | 70        | 1         | 0            | 0            | 71    |  |  |  |  |  |  |  |  |
| TY 04W     | Chan-Hom | 259       | 10        | 0            | 0            | 269   |  |  |  |  |  |  |  |  |

| TS 05W              | Linfa    | 200   | 6    | 26   | 2    | 234  |
|---------------------|----------|-------|------|------|------|------|
| TS 06W              | Nangka   | 102   | 3    | 0    | 0    | 105  |
| TY 07W              | Soudelor | 324   | 7    | 50   | 0    | 381  |
| TY 08W              | Koni     | 263   | 6    | 0    | 1    | 270  |
| STY 09W             | Imbudo   | 330   | 7    | 0    | 3    | 340  |
| TY 10W              | Morakot  | 139   | 0    | 50   | 0    | 189  |
| TY 11W              | Etau     | 287   | 6    | 117  | 0    | 410  |
| TY 12W              | Krovanh  | 349   | 1    | 0    | 3    | 353  |
| TS 13W              | Vamco    | 56    | 0    | 37   | 0    | 93   |
| TY 14W              | Dujuan   | 204   | 4    | 0    | 0    | 208  |
| STY 15W             | Maemi    | 309   | 5    | 60   | 1    | 375  |
| TY 16W              | Choi-Wan | 190   | 7    | 97   | 0    | 294  |
| TY 17W              | Koppu    | 236   | 9    | 0    | 0    | 245  |
| TD 18W              | -        | 116   | 6    | 0    | 0    | 122  |
| TD 19W              | -        | 68    | 1    | 0    | 0    | 69   |
| TY 20W              | Ketsana  | 290   | 8    | 0    | 0    | 298  |
| TY 21W              | Parma    | 440   | 10   | 0    | 0    | 450  |
| TD 22W              | -        | 62    | 3    | 0    | 0    | 65   |
| TS 23W              | -        | 148   | 2    | 0    | 0    | 150  |
| TY 24W              | Melor    | 173   | 4    | 18   | 0    | 195  |
| TY 25W              | Nepartak | 266   | 3    | 0    | 0    | 269  |
| STY 26W             | Lupit    | 528   | 9    | 0    | 0    | 537  |
| TS 27W              | -        | 127   | 2    | 0    | 0    | 129  |
| -                   | Totals   | 6340  | 138  | 478  | 13   | 6969 |
| Percentage of Total |          | 90.97 | 1.98 | 6.86 | 0.19 | 100  |

|                     |          |           | TABLE 3  | -3        |          |       |
|---------------------|----------|-----------|----------|-----------|----------|-------|
| 1                   | NORTHERI | N INDIAN  | OCEAN FI | X SUMMARY | FOR 2003 |       |
| Tropical Cy         | clone    | Satellite | Scatt    | Radar     | Synoptic | Total |
| TC 01B              | -        | 295       | 8        | 0         | 0        | 303   |
| TC 02A              | -        | 139       | 3        | 0         | 0        | 142   |
| TC 03B              | -        | 119       | 4        | 0         | 0        | 123   |
|                     | Totals   | 553       | 15       | 0         | 0        | 568   |
| Percentage of Total |          | 97.36     | 2.64     | 0         | 0        | 100   |

| TABLE 3-4             |                |  |  |  |  |  |  |  |  |  |
|-----------------------|----------------|--|--|--|--|--|--|--|--|--|
| FIXES BY OCEANIC      | BASIN FOR 2003 |  |  |  |  |  |  |  |  |  |
| Oceanic Basin         | Total Fixes    |  |  |  |  |  |  |  |  |  |
| Northwest Pacific     | 6969           |  |  |  |  |  |  |  |  |  |
| Southern Hemisphere   | 4867           |  |  |  |  |  |  |  |  |  |
| Northern Indian Ocean | 568            |  |  |  |  |  |  |  |  |  |
| Total                 | 12404          |  |  |  |  |  |  |  |  |  |

## 4. SUMMARY OF FORECAST VERIFICATION

## 4.1 ANNUAL FORECAST VERIFICATION

Verification of warning positions and intensities at initial, 12-, 24-, 48-, and 72-hour forecast periods are made against the final best track. The (scalar) track forecast, along-track and cross-track errors (illustrated in Figure 4-1) were calculated for each verifying JTWC forecast. These data, in addition to a detailed summary for each tropical cyclone, are included as Chapter 4. This section summarizes verification data this year and contrasts it with annual verification statistics from previous years.

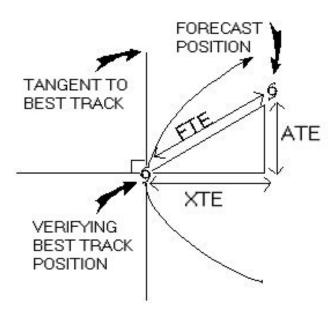


Figure 4-1. Definition of cross-track error (XTE), along-track error (ATE), and forecast track error (FTE). In this example, the forecast position is ahead of and to the right of the verifying best track position. Therefore, the XTE is positive (to the right of the best track) and the ATE is positive (ahead or faster than the best track). Adapted from Tsui and Miller, 1988.

#### 4.1.1 WESTERN NORTH PACIFIC OCEAN

Table 4-1 includes mean track, along-track and cross-track errors from 1959, when JTWC was founded, until the present. Figure 4-2 shows mean track errors and a 5-year running mean of track errors at 24-, 48- and 72-hours since 1974.

# Table 4-1 MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2003

|                 | 24-HOL | JR     |                       | 48-HOL | JR     |                       | 72-HOL | JR     |                       |                       |
|-----------------|--------|--------|-----------------------|--------|--------|-----------------------|--------|--------|-----------------------|-----------------------|
| YEAR<br>(Notes) | TY (1) | TC (3) | ALONG<br>TRACK<br>(2) |        | TC (3) | CROSS<br>TRACK<br>(2) |        | TC (3) | CROSS<br>TRACK<br>(2) | ALONG<br>TRACK<br>(2) |
| 1959            | 117*   |        |                       | 267*   |        |                       |        |        |                       |                       |
| 1960            | 177*   |        |                       | 354*   |        |                       |        |        |                       |                       |
| 1961            | 136    |        |                       | 274    |        |                       |        |        |                       |                       |
| 1962            | 144    |        |                       | 287    |        |                       | 476    |        |                       |                       |
| 1963            | 127    |        |                       | 246    |        |                       | 374    |        |                       |                       |
| 1964            | 133    |        |                       | 284    |        |                       | 429    |        |                       |                       |
| 1965            | 151    |        |                       | 303    |        |                       | 418    |        |                       |                       |
| 1966            | 136    |        |                       | 280    |        |                       | 432    |        |                       |                       |
| 1967            | 125    |        |                       | 276    |        |                       | 414    |        |                       |                       |
| 1968            | 105    |        |                       | 229    |        |                       | 337    |        |                       |                       |

| 1969   | 111 |     |    |    | 237 |     |     |     | 349 |     |     |     |
|--------|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1970   | 98  | 104 |    |    | 181 | 190 |     |     | 272 | 279 |     |     |
| 1971   | 99  | 111 | 64 |    | 203 | 212 | 118 |     | 308 | 317 | 177 |     |
| 1972   | 116 | 117 | 72 |    | 245 | 245 | 146 |     | 382 | 381 | 210 |     |
| 1973   | 102 | 108 | 74 |    | 193 | 197 | 134 |     | 245 | 253 | 162 |     |
| 1974   | 114 | 120 | 78 |    | 218 | 226 | 157 |     | 357 | 348 | 245 |     |
| 1975   | 129 | 138 | 84 |    | 279 | 288 | 181 |     | 442 | 450 | 290 |     |
| 1976   | 117 | 117 | 71 |    | 232 | 230 | 132 |     | 336 | 338 | 202 |     |
| 1977   | 140 | 148 | 83 |    | 266 | 283 | 157 |     | 390 | 407 | 228 |     |
| 1978   | 120 | 127 | 71 | 87 | 241 | 271 | 151 | 194 | 459 | 410 | 218 | 296 |
| 1979   | 113 | 124 | 76 | 81 | 219 | 226 | 138 | 146 | 319 | 316 | 182 | 214 |
| 1980   | 116 | 126 | 76 | 86 | 221 | 243 | 147 | 165 | 362 | 389 | 230 | 266 |
| 1981   | 117 | 124 | 77 | 80 | 215 | 221 | 131 | 146 | 342 | 334 | 219 | 206 |
| 1982   | 114 | 113 | 70 | 74 | 229 | 238 | 142 | 162 | 337 | 342 | 211 | 223 |
| 1983   | 110 | 117 | 73 | 76 | 247 | 260 | 164 | 169 | 384 | 407 | 263 | 259 |
| 1984   | 110 | 117 | 64 | 84 | 228 | 232 | 131 | 163 | 361 | 363 | 216 | 238 |
| 1985   | 112 | 117 | 68 | 80 | 228 | 231 | 138 | 153 | 355 | 367 | 227 | 230 |
| 1986   | 117 | 126 | 70 | 85 | 261 | 261 | 151 | 183 | 403 | 394 | 227 | 276 |
| 1987   | 101 | 107 | 64 | 71 | 211 | 204 | 127 | 134 | 318 | 303 | 186 | 198 |
| 1988   | 107 | 114 | 58 | 85 | 222 | 216 | 103 | 170 | 327 | 315 | 159 | 244 |
| 1989   | 107 | 120 | 69 | 83 | 214 | 231 | 127 | 162 | 325 | 350 | 177 | 265 |
| 1990   | 98  | 103 | 60 | 72 | 191 | 203 | 110 | 148 | 299 | 310 | 168 | 225 |
| 1991   | 93  | 96  | 53 | 69 | 187 | 185 | 97  | 137 | 298 | 287 | 146 | 229 |
| 1992   | 97  | 107 | 59 | 77 | 194 | 205 | 116 | 143 | 295 | 305 | 172 | 210 |
| 1993   | 102 | 112 | 63 | 79 | 205 | 212 | 117 | 151 | 320 | 321 | 173 | 226 |
| 1994** | 96  | 105 | 56 | 76 | 172 | 186 | 105 | 131 | 244 | 258 | 152 | 176 |
| 1995   | 105 | 123 | 67 | 89 | 200 | 215 | 117 | 159 | 311 | 325 | 167 | 240 |
| 1996   | 85  | 105 | 56 | 76 | 157 | 178 | 89  | 134 | 252 | 272 | 137 | 203 |
| 1997   | 86  | 93  | 55 | 76 | 159 | 164 | 87  | 134 | 251 | 245 | 120 | 202 |
| 1998   | 127 | 124 | 58 | 98 | 263 | 239 | 127 | 178 | 392 | 370 | 201 | 274 |

| 1999                         | 88  | 106 | 59 | 74 | 150 | 176 | 102 | 119 | 225 | 234 | 139 | 155 |
|------------------------------|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2000                         | 75  | 81  | 45 | 57 | 136 | 142 | 80  | 98  | 205 | 209 | 118 | 144 |
| 2001                         | 66  | 73  | 42 | 49 | 114 | 122 | 75  | 78  | 169 | 180 | 110 | 120 |
| 2002                         | 50  | 66  | 37 | 47 | 94  | 116 | 67  | 79  | 144 | 166 | 88  | 120 |
| 2003                         | 59  | 73  | 41 | 52 | 119 | 128 | 68  | 94  | 186 | 186 | 89  | 147 |
|                              |     |     |    |    |     |     |     |     |     |     |     |     |
|                              |     |     |    |    |     |     |     |     |     |     |     |     |
| Averages<br>(1978 -<br>2003) | 100 | 108 | 61 | 75 | 195 | 204 | 116 | 143 | 303 | 306 | 174 | 214 |

- 1. Track errors were calculated for typhoons when intensities were at least 65kts at warning times
- 2. Cross-track and along-track errors were adopted by the JTWC in 1986. Right angle errors (used prior to 1986) were recomputed as cross-track errors after-the fact to extend the data base. See Figure 3-1 for the definitions of cross-track and along-track.
- 3. Mean forecast errors for all warned systems in Northwest Pacific.
- \*Forecast positions north of 35 degrees North latitude were not verified.
- \*\*1994 statistics were recalculated to resolve earlier Along and Cross-Track discrepancies.

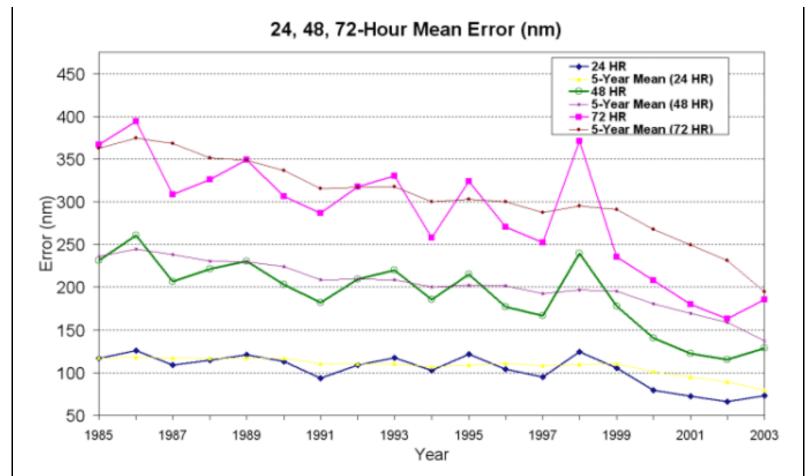


Figure 4-2a. Mean track forecast error (nm) and 5-year running mean for 24, 48 and 72 hours for Western North Pacific Ocean tropical cyclones from 1985-2003.

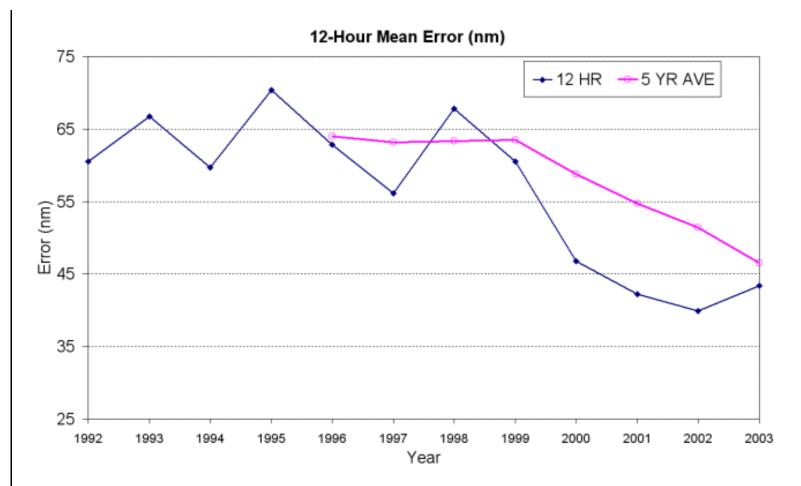


Figure 4-2b. Mean track forecast error (nm) and 5-year running mean for 12 hours for western North Pacific Ocean tropical cyclones from 1992-2003.

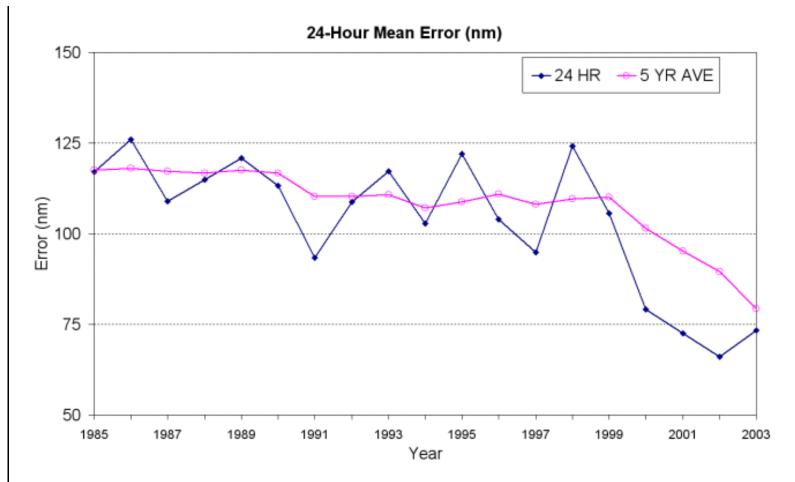


Figure 4-2c. Mean track forecast error (nm) and 5-year running mean for 24 hours for western North Pacific Ocean tropical cyclones from 1985-2003.

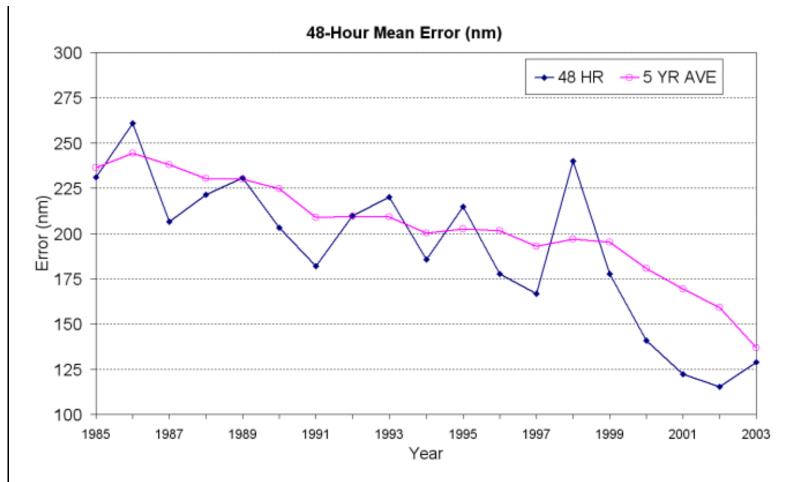


Figure 4-2d. Mean track forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1985-2003.

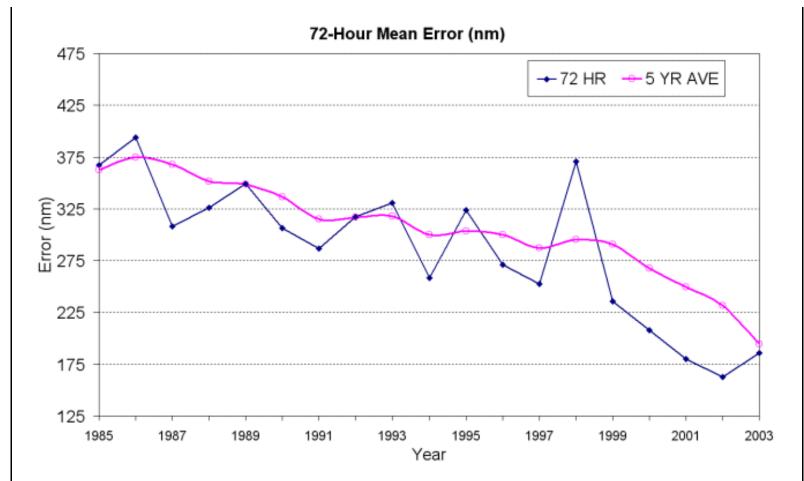


Figure 4-2e. Mean track forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1985-2003.

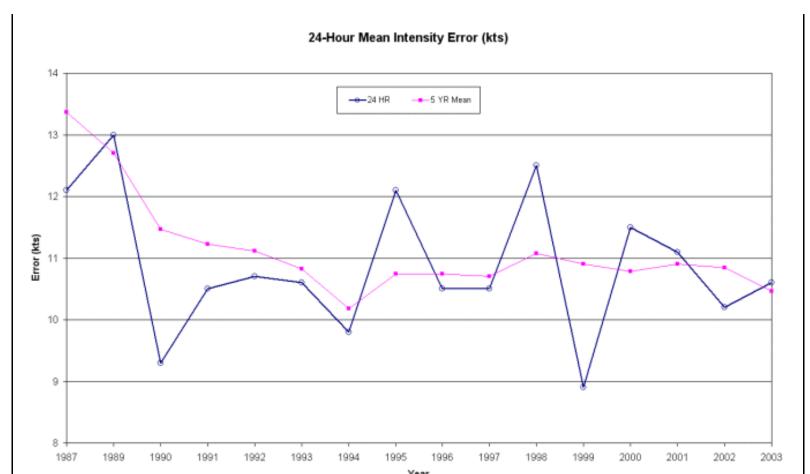


Figure 4-3a. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for western North Pacific Ocean tropical cyclones from 1987-2003.



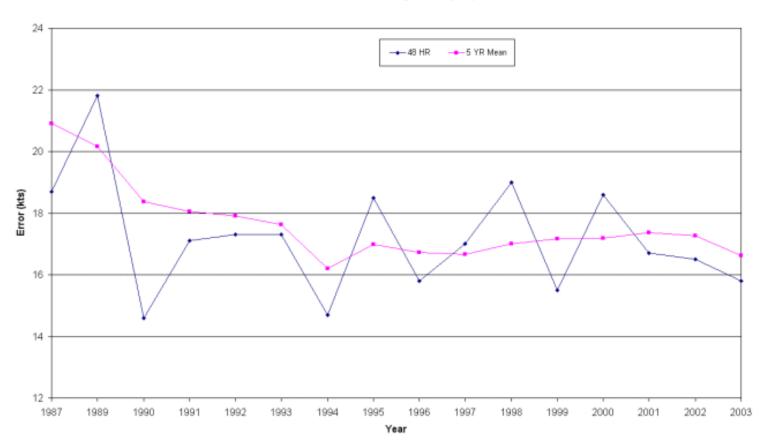


Figure 4-3b. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1987-2003.

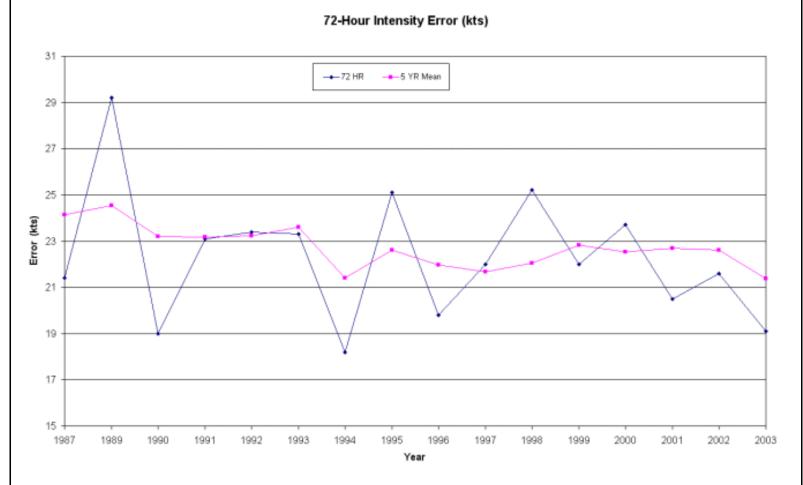


Figure 4-3c. Mean intensity forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1987-2003.

## **4.1.2 NORTH INDIAN OCEAN**

|     |                     |       |         |       |       | T     | able 4-2 | 2      |        |       |         |        |       |       |
|-----|---------------------|-------|---------|-------|-------|-------|----------|--------|--------|-------|---------|--------|-------|-------|
| JTW | C INITIA            | L PO  | SITION  | AND   | FORE  | CAST  | ERROF    | RS (NI | M) FOF | R THE | NORTH   | I INDI | AN O  | CEAN  |
|     |                     |       |         |       |       | 19    | 985-200  | 3      |        |       |         |        |       |       |
|     | 4                   |       |         |       |       |       |          |        |        |       |         |        |       |       |
|     | Initial<br>Position | ì     | 24-Hour |       |       |       | 48-Hour  |        |        |       | 72-Hour |        |       |       |
|     | Number              | Error | Number  | Track | Along | Cross | Number   | Track  | Along  | Cross | Number  | Track  | Along | Cross |
|     | ,                   | ,     | ,       | ,     | ,     | ,     |          | ,      | ,      |       |         |        | ,     |       |

| 1985  | 53      | 31 | 30  | 122 | 102 | 53  | 8   | 242 | 119 | 194 | 0  |      |      |      |
|-------|---------|----|-----|-----|-----|-----|-----|-----|-----|-----|----|------|------|------|
| 1986  | 28      | 52 | 16  | 134 | 118 | 53  | 7   | 168 | 131 | 80  | 5  | 269  | 189  | 180  |
| 1987  | 83      | 42 | 54  | 144 | 97  | 100 | 25  | 205 | 125 | 140 | 21 | 305  | 219  | 188  |
| 1988  | 44      | 34 | 30  | 120 | 89  | 63  | 18  | 219 | 112 | 176 | 12 | 409  | 227  | 303  |
| 1989  | 44      | 19 | 33  | 88  | 62  | 50  | 17  | 146 | 94  | 86  | 12 | 216  | 164  | 11   |
| 1990  | 46      | 31 | 36  | 101 | 85  | 43  | 24  | 146 | 117 | 67  | 17 | 185  | 130  | 104  |
| 1991  | 56      | 38 | 43  | 129 | 107 | 54  | 27  | 235 | 200 | 89  | 14 | 450  | 356  | 178  |
| 1992  | 191     | 35 | 149 | 128 | 73  | 86  | 100 | 244 | 141 | 166 | 62 | 398  | 276  | 218  |
| 1993  | 36      | 27 | 28  | 125 | 87  | 79  | 20  | 198 | 171 | 74  | 12 | 231  | 176  | 116  |
| 1994  | 60      | 25 | 44  | 97  | 80  | 44  | 28  | 153 | 124 | 63  | 13 | 213  | 177  | 92   |
| 1995  | 54      | 30 | 47  | 138 | 119 | 58  | 32  | 262 | 247 | 77  | 20 | 342  | 304  | 109  |
| 1996  | 135     | 33 | 123 | 134 | 94  | 80  | 85  | 238 | 181 | 127 | 58 | 311  | 172  | 237  |
| 1997  | 56      | 29 | 42  | 119 | 87  | 49  | 29  | 201 | 168 | 92  | 17 | 228  | 195  | 110  |
| 1998  | 80      | 20 | 55  | 106 | 84  | 51  | 34  | 198 | 135 | 106 | 17 | 262  | 188  | 144  |
| 1999  | 49      | 8  | 41  | 79  | 59  | 38  | 22  | 184 | 130 | 116 | 10 | 374  | 309  | 177  |
| 2000  | 31      | 15 | 24  | 61  | 47  | 26  | 16  | 85  | 69  | 37  | 1  | 401  | 399  | 38   |
| 2001  | 50      | 12 | 41  | 61  | 40  | 37  | 31  | 115 | 71  | 71  | 22 | 166  | 44   | 154  |
| 2002  | 42      | 18 | 26  | 79  | 63  | 38  | 11  | 120 | 95  | 55  | 3  | 132  | 86   | 89   |
| 2003  | 40      | 22 | 37  | 108 | 66  | 69  | 31  | 196 | 115 | 132 | 7  | 354  | 210  | 252  |
| (1985 | 5-2002) | ,  | ,   | ,   | ,   | ,   | ,   | ,   | ,   | ,   | ,  | ,    | ,    | ,    |
| Avg   | 63      | 29 | 48  | 110 | 82  | 57  | 30  | 188 | 135 | 103 | 19 | 291* | 213* | 146* |

Table 4-2 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-6 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1985, and at 72-hours since 1986.



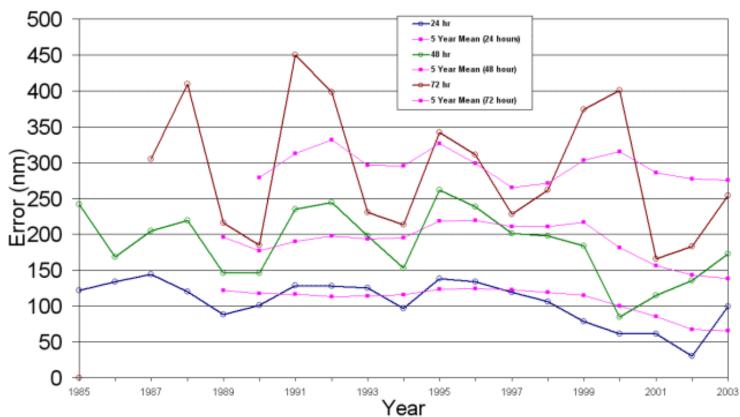


Figure 4-4a. Mean track forecast error (nm) and 5-year running mean for 24, 48 and 72 hours for North Indian Ocean tropical cyclones from 1985-2003.

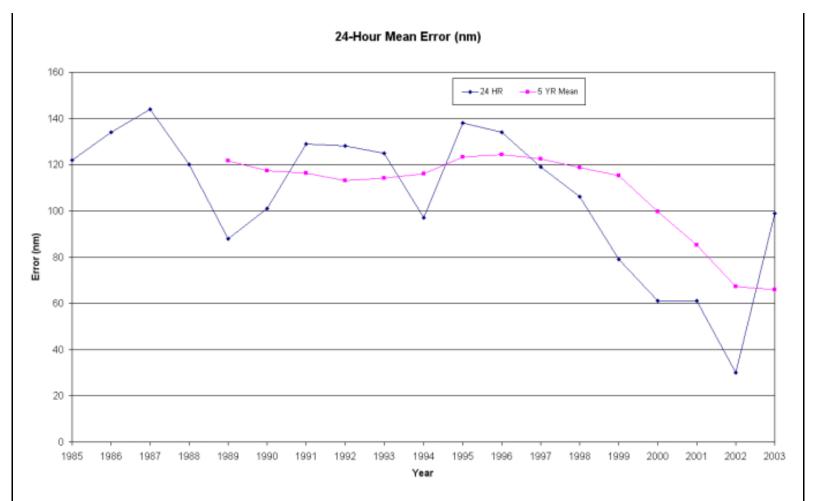


Figure 4-4b. Mean track forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1985-2003.

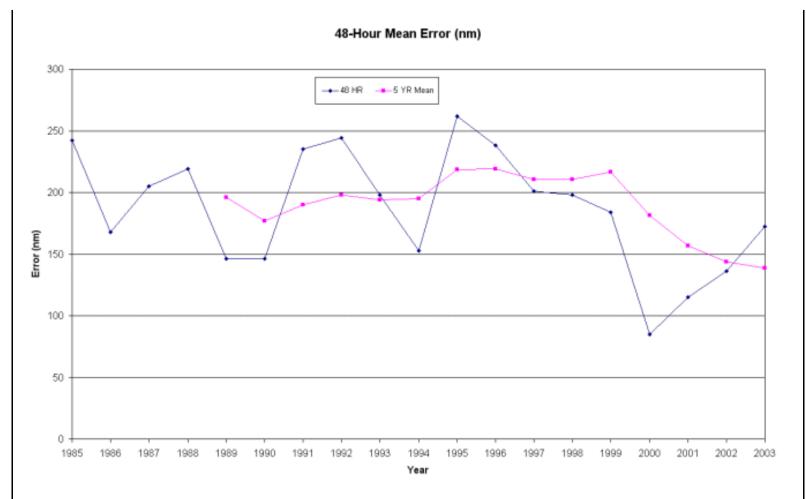


Figure 4-4c. Mean track forecast error (nm) and 5-year running mean for 48 hours for North Indian Ocean tropical cyclones from 1985-2003.

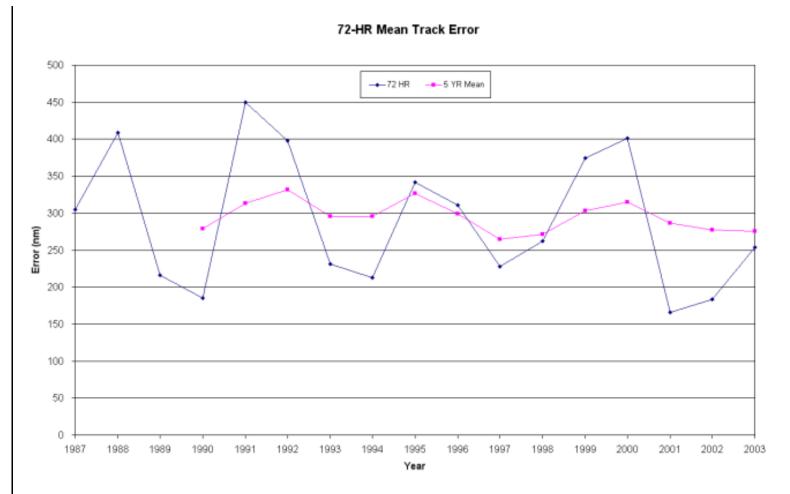


Figure 4-4d. Mean track forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1987-2003.

## 24, 48, 72-Hour Intensity Error (kts)

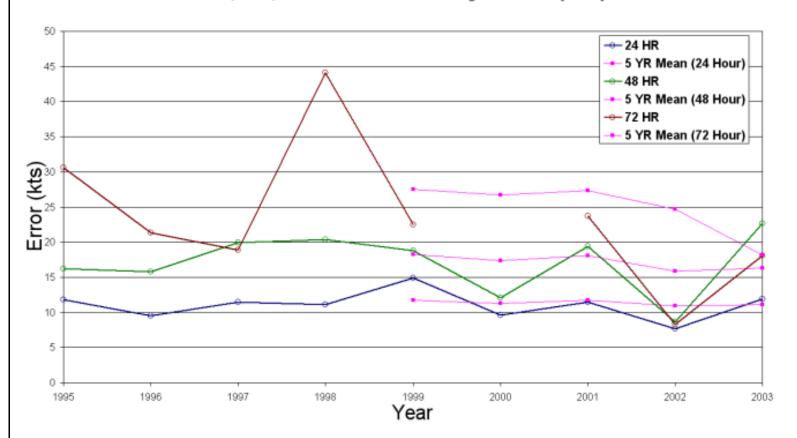


Figure 4-5a. Mean intensity forecast error (nm) and 5-year running mean for 24, 48 and 72 hours for North Indian Ocean tropical cyclones from 1995-2003.

## 24-Hour Intensity Error (kts)

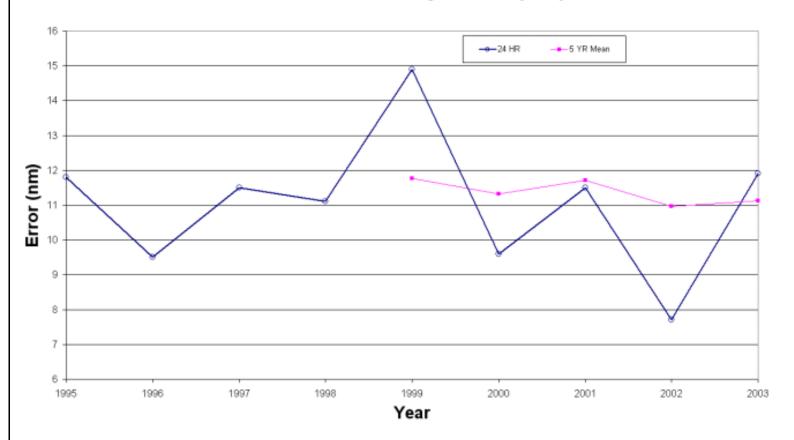


Figure 4-5b. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1995-2003.



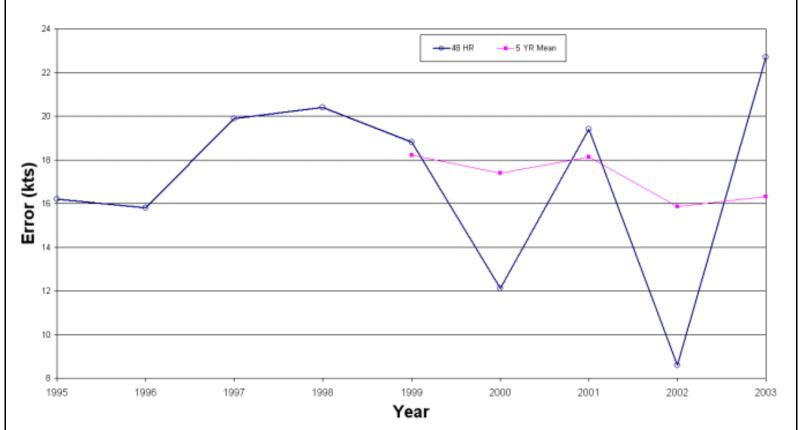


Figure 4-5c. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for North Indian Ocean tropical cyclones from 1995-2003.

## 72-Hour Intensity Error (kts)

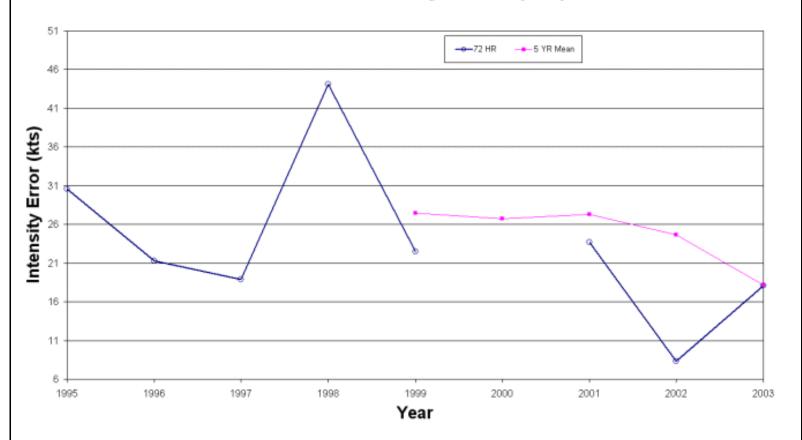


Figure 4-5d. Mean intensity forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1995-2003.

# 4.1.3 SOUTH PACIFIC AND SOUTH INDIAN OCEANS (SOUTHERN HEMISPHERE)

Table 4-3

## JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE SOUTHERN HEMISPHERE

#### 1985-2003

|      | Initial<br>Position | )     | 24-Hour |       |       |       | 48-Hour |       |       |       | 72-Hour |       |       |       |
|------|---------------------|-------|---------|-------|-------|-------|---------|-------|-------|-------|---------|-------|-------|-------|
|      | Number              | Error | Number  | Track | Along | Cross | Number  | Track | Along | Cross | Number  | Track | Along | Cross |
| 1985 | 306                 | 36    | 257     | 134   | 92    | 79    | 193     | 236   | 169   | 132   |         |       |       |       |
| 1986 | 279                 | 40    | 227     | 129   | 86    | 77    | 171     | 262   | 169   | 164   |         |       |       |       |
| 1987 | 189                 | 46    | 138     | 145   | 94    | 90    | 101     | 280   | 153   | 138   |         |       |       |       |
| 1988 | 204                 | 34    | 99      | 146   | 98    | 83    | 48      | 290   | 246   | 144   |         |       |       |       |
| 1989 | 287                 | 31    | 242     | 124   | 84    | 73    | 186     | 240   | 166   | 136   |         |       |       |       |
| 1990 | 272                 | 27    | 228     | 143   | 105   | 74    | 177     | 263   | 178   | 152   |         |       |       |       |
| 1991 | 264                 | 24    | 231     | 115   | 75    | 69    | 185     | 220   | 152   | 129   |         |       |       |       |
| 1992 | 267                 | 28    | 230     | 124   | 91    | 64    | 208     | 240   | 177   | 129   |         |       |       |       |
| 1993 | 257                 | 21    | 225     | 102   | 74    | 57    | 176     | 199   | 142   | 114   |         |       |       |       |
| 1994 | 386                 | 28    | 345     | 115   | 77    | 68    | 282     | 224   | 147   | 134   |         |       |       |       |
| 1995 | 245                 | 24    | 222     | 108   | 82    | 55    | 175     | 198   | 144   | 108   | 53      | 291   | 169   | 190   |
| 1996 | 343                 | 24    | 298     | 125   | 90    | 67    | 237     | 240   | 174   | 129   | 46      | 277   | 221   | 133   |
| 1997 | 561                 | 24    | 499     | 109   | 82    | 72    | 442     | 210   | 163   | 135   | 150     | 288   | 248   | 175   |
| 1998 | 329                 | 26    | 305     | 111   | 85    | 52    | 245     | 219   | 169   | 108   | 81      | 349   | 261   | 171   |
| 1999 | 348                 | 17    | 322     | 113   | 80    | 64    | 245     | 226   | 159   | 132   | 59      | 286   | 198   | 164   |
| 2000 | 384                 | 12    | 313     | 72    | 47    | 45    | 245     | 135   | 84    | 86    | 58      | 180   | 94    | 139   |
| 2001 |                     | 13    | 147     | 84    | 61    | 44    | 113     | 148   | 105   | 86    | 11      | 248   | 133   | 197   |
| 2002 | 242                 | 15    | 200     | 82    | 60    | 43    | 146     | 133   | 93    | 75    | 5       | 102   | 91    | 41    |
| 2003 | 326                 | 14    | 279     | 74    | 57    | 37    | 221     | 127   | 90    | 68    | 37      | 123   | 99    | 54    |

| (1985 | 5-2002)   |    |     |     |    |    |     |     |     |     |     |      |      |      |
|-------|-----------|----|-----|-----|----|----|-----|-----|-----|-----|-----|------|------|------|
| Avg   | 296       | 26 | 252 | 116 | 82 | 65 | 199 | 220 | 155 | 124 | 58* | 253* | 177* | 151* |
| *8-ye | ar averag | je |     |     |    |    |     |     |     |     |     |      |      |      |

Table 4-3 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-7 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1981, and at 72-hours since 1995.

## 24, 48, 72-Hour Mean Error (nm)

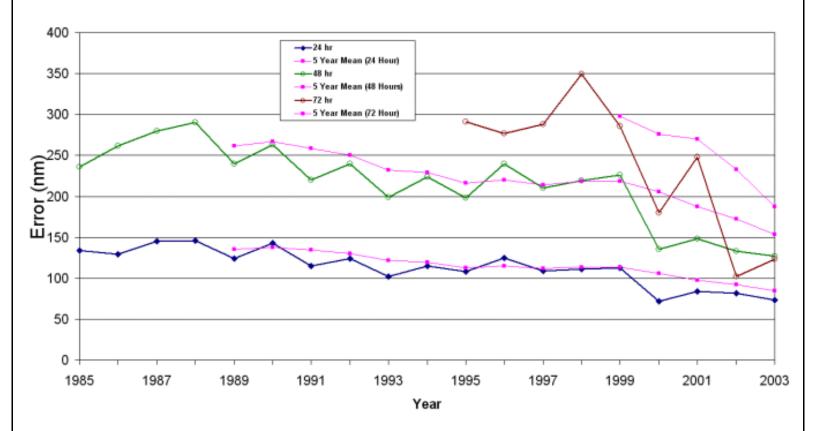


Figure 4-6a. Mean track forecast error (nm) and 5-year running mean for 24, 48 and 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.



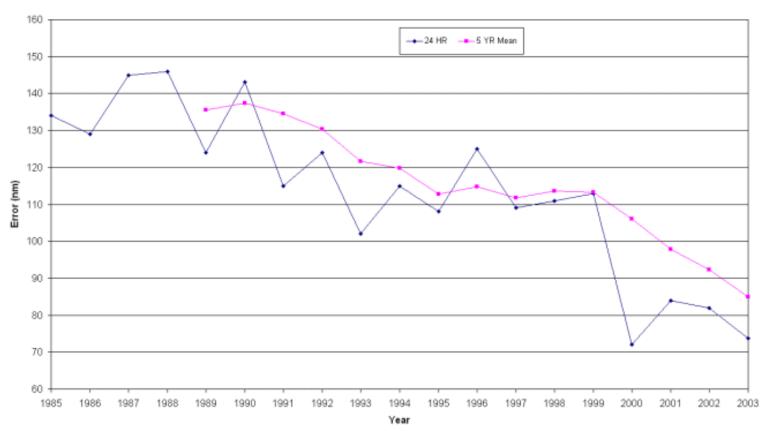


Figure 4-6b. Mean track forecast error (nm) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.

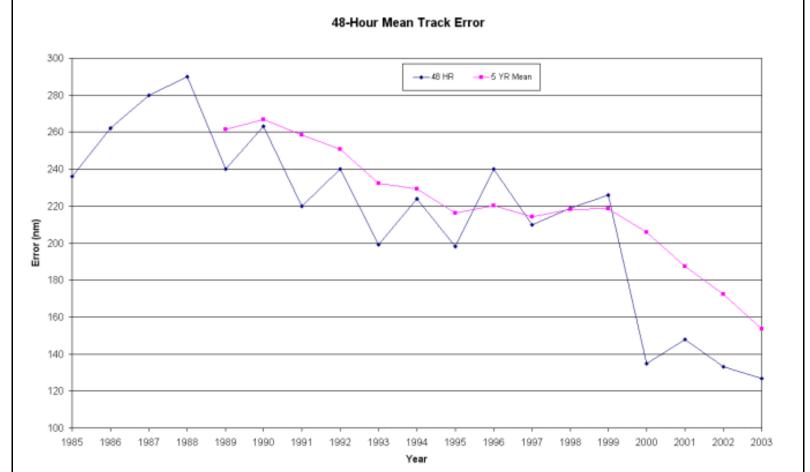


Figure 4-6c. Mean track forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.

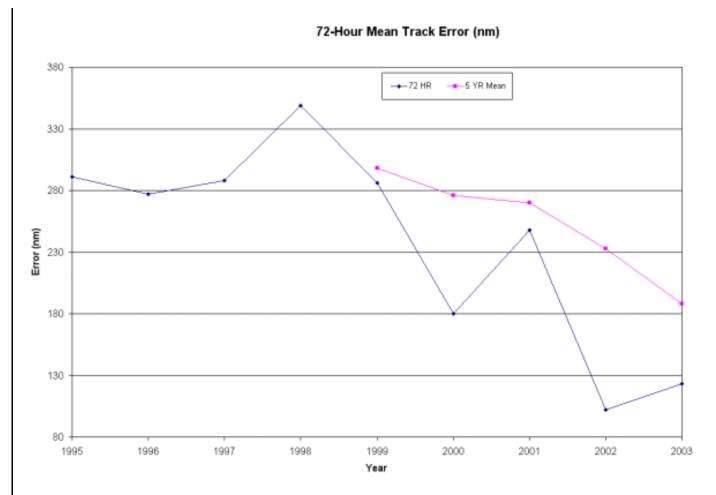


Figure 4-6d. Mean track forecast error (nm) at 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1995-2003.

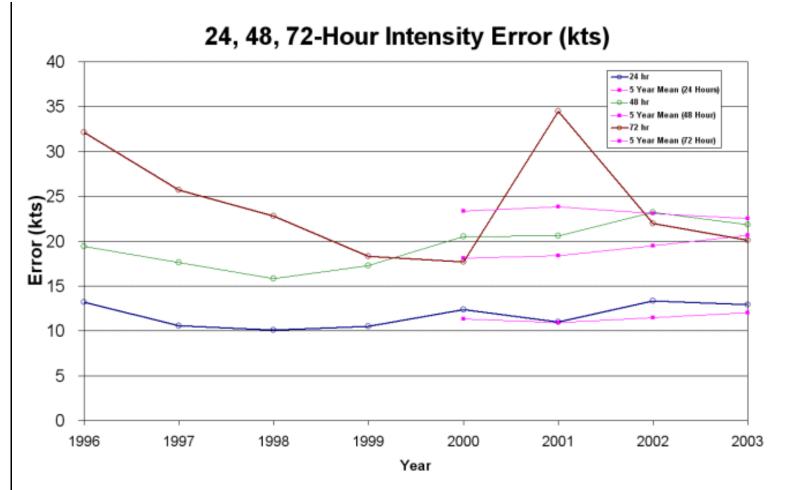


Figure 4-7a. Mean intensity forecast error (nm) and 5-year running mean for 24, 48 and 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.

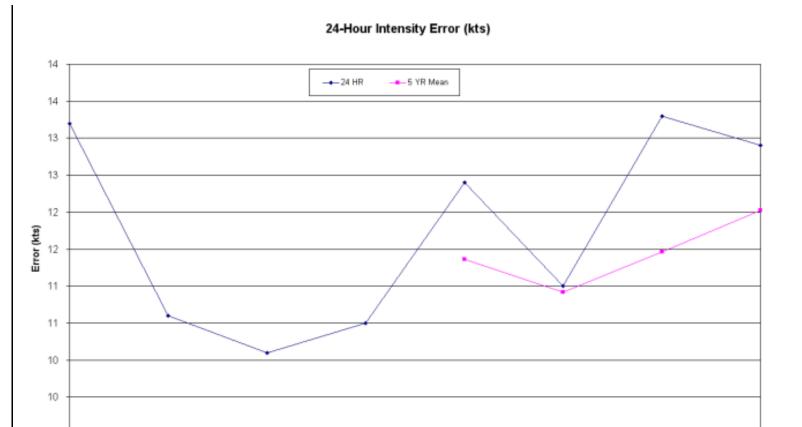


Figure 4-7b. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.

Year



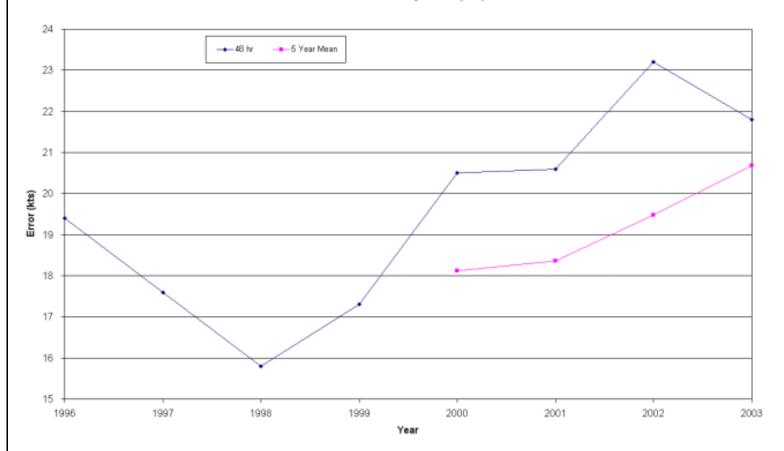


Figure 4-7c. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.

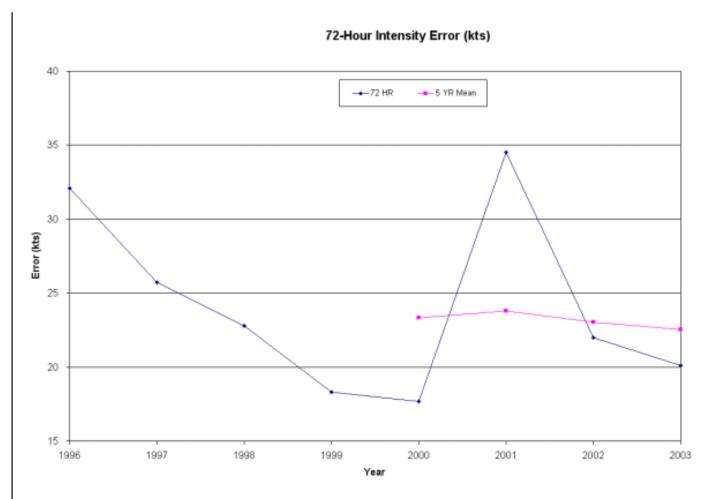


Figure 4-7d. Mean track forecast error (nm) and 5-year running mean for 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.

## Go To: 4.2 TESTING AND RESULTS

## 4.2 TESTING AND RESULTS

A comparison of selected techniques is included in Table 4-4 for all western North Pacific tropical cyclones, Table 4-5 for North Indian Ocean tropical cyclones, and Table 4-6 for Southern Hemisphere tropical cyclones.

For example, in Table 4-4 for the homogeneous comparison of the 12-hour mean forecast error between JTWC and NGPS, 611 cases were available. The average forecast error at 12 hours was 55 nm for NGPS and 42 nm for JTWC. The difference of 13 nm is shown in the lower right. Due to computational round-off, differences are not always exact.

| Error Statistics for Selected | Obiective Technique | s Western North Pag | cific Ocean |
|-------------------------------|---------------------|---------------------|-------------|

Table 4-4

|      | JTW | С  | NGF | PS  | EGF | RR  | AFV | <b>V</b> 1 | GFD | N   | JGS | M   | JTY | М   | JAV | N   | CLIF | >   | CON | ١U | CON | W  |
|------|-----|----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|----|-----|----|
| JTWC | 648 | 43 |     |     |     |     |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
|      | 43  | 0  |     |     |     |     |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
| NGPS | 611 | 42 | 662 | 61  |     |     |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
|      | 55  | 13 | 61  | 0   |     |     |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
| EGRR | 304 | 44 | 305 | 55  | 329 | 69  |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
|      | 64  | 20 | 63  | 8   | 69  | 0   |     |            |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
| AFW1 | 252 | 42 | 257 | 52  | 241 | 61  | 259 | 85         |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
|      | 86  | 44 | 85  | 33  | 87  | 26  | 85  | 0          |     |     |     |     |     |     |     |     |      |     |     |    |     |    |
| GFNI | 436 | 40 | 430 | 52  | 214 | 62  | 201 | 82         | 440 | 53  |     |     |     |     |     |     |      |     |     |    |     |    |
|      | 52  | 12 | 52  | 0   | 52  | -10 | 51  | -31        | 53  | 0   |     |     |     |     |     |     |      |     |     |    |     |    |
| JGSM | 251 | 42 | 248 | 53  | 245 | 57  | 215 | 83         | 191 | 51  | 256 | 57  |     |     |     |     |      |     |     |    |     |    |
|      | 56  | 14 | 56  | 3   | 57  | 0   | 55  | -28        | 54  | 3   | 57  | 0   |     |     |     |     |      |     |     |    |     |    |
| JTYM | 464 | 42 | 454 | 54  | 218 | 60  | 186 | 84         | 347 | 52  | 214 | 58  | 471 | 57  |     |     |      |     |     |    |     |    |
|      | 55  | 13 | 53  | -1  | 54  | -6  | 52  | -32        | 49  | -3  | 58  | 0   | 57  | 0   |     |     |      |     |     |    |     |    |
| JAVN | 576 | 42 | 597 | 59  | 290 | 68  | 228 | 83         | 392 | 51  | 224 | 52  | 418 | 55  | 706 | 68  |      |     |     |    |     |    |
|      | 60  | 18 | 60  | 1   | 59  | -9  | 55  | -28        | 55  | 4   | 52  | 0   | 57  | 2   | 68  | 0   |      |     |     |    |     |    |
| CLIP | 644 | 43 | 653 | 60  | 323 | 68  | 256 | 86         | 440 | 53  | 255 | 57  | 470 | 57  | 662 | 66  | 753  | 59  |     |    |     |    |
|      | 54  | 11 | 54  | -6  | 56  | -12 | 53  | -33        | 52  | -1  | 53  | -4  | 54  | -3  | 58  | -8  | 59   | 0   |     |    |     |    |
| CONU | 620 | 42 | 618 | 57  | 305 | 66  | 254 | 86         | 440 | 53  | 249 | 57  | 460 | 56  | 589 | 61  | 663  | 55  | 663 | 45 |     |    |
|      | 43  | 1  | 42  | -15 | 45  | -21 | 42  | -44        | 40  | -13 | 43  | -14 | 42  | -14 | 44  | -17 | 45   | -10 | 45  | 0  |     |    |
| CONW | 493 | 43 | 499 | 60  | 243 | 71  | 196 | 83         | 338 | 53  | 197 | 57  | 385 | 57  | 490 | 63  | 553  | 56  | 517 | 45 | 553 | 45 |
|      | 41  | -2 | 42  | -18 | 44  | -27 | 41  | -42        | 38  | -15 | 42  | -15 | 39  | -18 | 44  | -19 | 45   | -11 | 44  | -1 | 45  | 0  |

| 24-HOL | JR MI | EAN | FOR | ECA | ST E | RRC | R (N | M)  |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|--------|-------|-----|-----|-----|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------------|-----|----|-----|----|
|        | JTW   | С   | NGF | PS  | EGF  | RR  | AFW  | /1  | GFE | N N | JGS | M   | JTY | M   | JAV | N   | CLIF | <b></b>     | CON | ١U | CON | IW |
| JTWC   | 602   | 73  |     |     |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 73    | 0   |     |     |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| NGPS   | 563   | 72  | 611 | 88  |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 81    | 9   | 88  | 0   |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| EGRR   | 282   | 75  | 279 | 81  | 306  | 98  |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 93    | 18  | 92  | 11  | 98   | 0   |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| AFW1   | 235   | 72  | 236 | 79  | 224  | 93  | 241  | 120 |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 121   | 49  | 119 | 40  | 122  | 29  | 120  | 0   |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| GFNI   | 406   | 67  | 398 | 77  | 200  | 93  | 190  | 118 | 410 | 96  |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 96    | 29  | 95  | 18  | 92   | -1  | 92   | -26 | 96  | 0   |     |     |     |     |     |     |      |             |     |    |     |    |
| JGSM   | 238   | 72  | 231 | 78  | 232  | 85  | 204  | 118 | 180 | 93  | 242 | 83  |     |     |     |     |      |             |     |    |     |    |
|        | 81    | 9   | 82  | 4   | 83   | -2  | 82   | -36 | 78  | -15 | 83  | 0   |     |     |     |     |      |             |     |    |     |    |
| JTYM   | 435   | 71  | 423 | 80  | 204  | 89  | 175  | 118 | 327 | 95  | 204 | 83  | 442 | 84  |     |     |      |             |     | ,  |     |    |
|        | 80    | 9   | 80  | 0   | 83   | -6  | 76   | -42 | 72  | -23 | 86  | 3   | 84  | 0   |     |     |      |             |     |    |     |    |
| JAVN   | 538   | 71  | 556 | 87  | 271  | 96  | 213  | 118 | 368 | 94  | 213 | 77  | 394 | 81  | 664 | 90  |      |             |     |    |     |    |
|        | 83    | 12  | 82  | -5  | 82   | -14 | 74   | -44 | 76  | -18 | 75  | -2  | 80  | -1  | 90  | 0   |      |             |     |    |     |    |
| CLIP   | 598   | 73  | 604 | 88  | 300  | 97  | 239  | 121 | 410 | 96  | 241 | 83  | 441 | 84  | 622 | 88  | 707  | 112         |     |    |     |    |
|        | 107   | 34  | 106 | 18  | 108  | 11  | 107  | -14 | 107 | 11  | 106 | 23  | 108 | 24  | 110 | 22  | 112  | 0           |     |    |     |    |
| CONU   | 574   | 72  | 571 | 84  | 282  | 95  | 237  | 121 | 410 | 96  | 235 | 83  | 431 | 83  | 552 | 82  | 618  | 109         | 618 | 76 |     |    |
|        | 72    | 0   | 71  | -13 | 76   | -19 | 70   | -51 | 67  | -29 | 72  | -11 | 71  | -12 | 74  | -8  | 76   | -33         | 76  | 0  |     |    |
| CONW   | 454   | 74  | 459 | 89  | 223  | 99  | 183  | 120 | 312 | 98  | 184 | 82  | 358 | 82  | 462 | 85  | 515  | 108         | 480 | 79 | 515 | 74 |
|        | 69    | -5  | 69  | -20 | 74   | -25 | 67   | -53 | 62  | -36 | 69  | -13 | 66  | -16 | 72  | -13 | 74   | -34         | 74  | -5 | 74  | 0  |
| 36-HOL | 69    | -5  | 69  | -20 | 74   | -25 | 67   | -53 |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | JTW   | С   | NGF | PS  | EGF  | RR  | AFV  | /1  | GFE | N   | JGS | M   | JTY | M   | JAV | N   | CLIF | <b>&gt;</b> | CON | ١U | CON | I۷ |
| JTWC   | 550   | 102 |     |     |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 102   |     |     |     |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| NGPS   | 513   | 100 | 560 | 121 |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 115   | 15  | 121 | 0   |      |     |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| EGRR   | 255   | 103 | 253 | 115 | 279  | 126 |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 122   | 19  | 120 | 5   | 126  | 0   |      |     |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| AFW1   | 215   | 103 | 216 | 115 | 202  | 124 | 221  | 172 |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 171   | 68  | 168 | 53  | 172  | 48  | 172  | 0   |     |     |     |     |     |     |     |     |      |             |     |    |     |    |
| GFNI   | 366   | 98  | 360 | 111 | 179  | 120 | 174  | 173 | 370 | 141 |     |     |     |     |     |     |      |             |     |    |     |    |
|        | 140   | 42  | 139 | 28  | 139  | 19  | 139  | -34 | 141 | 0   |     |     |     |     |     |     |      |             |     |    |     |    |

| JGSM   | 219 | 102 | 213 | 115      | 210 | 120 | 189 | 167 | 168 | 142 | 222 | 108 |     |     |     |     |      |          |     |      |     |     |
|--------|-----|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----------|-----|------|-----|-----|
|        | 104 | 2   | 104 | -11      | 107 | -13 | 106 | -61 | 100 | -42 | 108 | 0   |     |     |     |     |      |          |     |      |     |     |
| JTYM   | 406 | 102 | 395 | 117      | 189 | 125 | 162 | 173 | 302 | 142 | 185 | 108 | 413 | 114 |     |     |      |          |     |      |     |     |
|        | 109 | 7   | 109 | -8       | 115 | -10 | 105 | -68 | 99  | -43 | 115 | 7   | 114 | 0   |     |     |      |          |     |      |     |     |
| JAVN   | 491 | 99  | 508 | 119      | 249 | 124 | 196 | 167 | 332 | 133 | 197 | 103 | 367 | 109 | 612 | 117 |      |          |     |      |     |     |
|        | 107 | 8   | 107 | -12      | 106 | -18 | 95  | -72 | 99  | -34 | 99  | -4  | 107 | -2  | 117 | 0   |      |          |     |      |     |     |
| CLIP   | 547 | 102 | 553 | 120      | 273 | 126 | 219 | 173 | 370 | 141 | 221 | 108 | 412 | 114 | 573 | 113 | 655  | 169      |     |      |     |     |
|        | 165 | 63  | 163 | 43       | 162 | 36  | 168 | -5  | 171 | 30  | 166 | 58  | 170 | 56  | 165 | 52  | 169  | 0        |     |      |     |     |
| CONU   | 525 | 102 | 523 | 117      | 256 | 124 | 217 | 172 | 370 | 141 | 217 | 107 | 403 | 112 | 506 | 108 | 568  | 167      | 568 | 106  |     |     |
|        | 101 | -1  | 100 | -17      | 106 | -18 | 101 | -71 | 95  | -46 | 103 | -4  | 103 | -9  | 102 | -6  | 106  | -61      | 106 | 0    |     |     |
| CONW   | 414 | 105 | 420 | 122      | 202 | 130 | 167 | 175 | 280 | 140 | 168 | 107 | 332 | 112 | 427 | 113 | 474  | 166      | 439 | 110  | 474 | 102 |
|        | 97  | -8  | 96  | -26      | 103 | -27 | 96  | -79 | 88  | -52 | 98  | -9  | 95  | -17 | 98  | -15 | 102  | -64      | 102 | -8   | 102 | 0   |
| 48-HOL | JTW |     | NGF |          | EGF |     | AFW |     | GFD | N   | JGS | M   | JTY | M   | JAV | N   | CLIF | <b>)</b> | CON | 1U   | CON | IW  |
| JTWC   | 495 | 128 |     |          |     |     |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
|        | 128 | 0   |     |          |     |     |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
| NGPS   | 464 | 127 | 514 | 156      |     |     |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
|        | 149 | 22  | 156 | 0        |     |     |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
| EGRR   | 229 | 125 | 231 | 146      | 252 | 151 |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
|        | 146 | 21  | 146 | 0        | 151 | 0   |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
| AFW1   | 194 | 133 | 199 | 148      | 183 | 149 | 200 | 225 |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
|        | 223 | 90  | 222 | 74       | 218 | 69  | 225 | 0   |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
| GFNI   | 321 | 121 | 324 | 145      | 160 | 140 | 154 | 224 | 328 | 179 |     |     |     |     |     |     |      |          |     |      |     |     |
|        | 176 | 55  | 179 | 34       | 170 | 30  | 180 | -44 | 179 | 0   |     |     |     |     |     |     |      |          |     |      |     |     |
| JGSM   | 197 | 130 | 195 | 150      | 191 | 148 | 169 | 217 | 149 | 176 | 200 | 138 |     |     |     |     |      |          |     |      |     |     |
|        | 133 | 3   | 134 | -16      | 135 | -13 | 135 | -82 | 128 | -48 | 138 | 0   |     |     |     |     |      |          |     |      |     |     |
| JTYM   | 368 | 131 | 363 | 155      | 174 | 155 | 148 | 236 | 271 | 183 | 167 | 141 | 377 | 145 |     |     |      |          |     |      |     |     |
|        | 139 | 8   | 137 | -18      | 148 | -7  | 139 | -97 | 129 | -54 | 151 | 10  | 145 | 0   |     |     |      |          |     |      |     |     |
| JAVN   | 447 | 125 | 468 | 155      | 226 | 147 | 179 | 216 | 300 | 175 | 179 | 135 | 338 | 140 | 568 | 144 |      |          |     |      |     |     |
|        | 135 | 10  | 138 | -17      | 130 | -17 | 127 | -89 | 130 | -45 | 130 | -5  | 139 | -1  | 144 | 0   |      |          |     |      |     |     |
| CLIP   | 493 | 128 | 507 | 155      | 246 | 152 | 198 | 226 | 328 | 179 | 199 | 138 | 376 | 144 | 530 | 141 | 604  | 231      |     |      |     |     |
|        |     |     |     |          | 221 |     |     |     |     |     |     |     |     |     | 226 |     | 231  |          |     |      |     |     |
|        |     | 128 | 477 | 153      | 229 |     |     |     |     |     |     |     |     |     |     |     |      |          | 517 |      |     |     |
| CONU   | 471 |     |     | <u> </u> |     |     |     | 00  | 121 | -58 | 133 | -3  | 134 | -8  | 132 | -6  | 135  | -96      | 135 | lo l |     |     |
|        | 128 | 0   |     |          | 130 |     |     |     |     |     |     |     |     |     |     |     |      |          |     |      |     |     |
| CONU   | 128 | 0   |     |          |     |     |     |     |     |     |     | 140 | 302 | 144 | 391 |     |      |          |     |      | 430 | 129 |

| 208<br>153<br>324<br>247<br>250                      | 0<br>184<br>28<br>184<br>24<br>189<br>135<br>178<br>72  | 221<br>178<br>207<br>157<br>331<br>251<br>252   | 0<br>207<br>0<br>202<br>129<br>210  | 213<br>138<br>303   | 0 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
|--|---|---|---|---|---|--|----------|------|-----|-----|--|---|-----|--|-----|-----|----------|-----|-----|--|--|
| 361<br>212<br>179<br>208<br>153<br>324<br>247<br>250 | 184<br>28<br>184<br>24<br>189<br>135<br>178<br>72   | 221<br>178<br>207<br>157<br>331<br>251<br>252   | 0<br>207<br>0<br>202<br>129<br>210  | 213<br>138<br>303   | 0 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 212<br>179<br>208<br>153<br>324<br>247<br>250        | 28<br>184<br>24<br>189<br>135<br>178<br>72  | 221<br>178<br>207<br>157<br>331<br>251<br>252   | 0<br>207<br>0<br>202<br>129<br>210  | 213<br>138<br>303   | 0 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 179<br>208<br>153<br>324<br>247<br>250<br>150        | 184<br>24<br>189<br>135<br>178<br>72  | 178<br>207<br>157<br>331<br>251<br>252  | 207<br>0<br>202<br>129<br>210   | 213<br>138<br>303   | 0 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 208<br>153<br>324<br>247<br>250<br>150               | 24<br>189<br>135<br>178<br>72   | 207<br>157<br>331<br>251<br>252   | 0<br>202<br>129<br>210  | 213<br>138<br>303   | 0 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 153<br>324<br>247<br>250<br>150                      | 189<br>135<br>178<br>72   | 157<br>331<br>251<br>252  | 202<br>129<br>210   | 138<br>303  | 208   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 324<br>247<br>250<br>150                             | 135<br>178<br>72  | 331<br>251<br>252   | 129<br>210  | 303   |   | 158  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 247<br>250<br>150                                    | 178<br>72   | 251<br>252  | 210   |   | 95  |  | 334      |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 250<br>150   | 72  | 252   |   | 123   | 1   | 334  | 0        |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 150  |   |   | 42  |   | 204   | 120  | 337      | 256  | 253 |     |  |   |     |  |     |     |          |     |     |  |  |
|  | 192   |   | 42  | 243   | 39  | 244  | -93      | 253  | 0   |     |  |   |     |  |     |     |          |     |     |  |  |
| 194  |   | 150   | 214   | 143   | 213   | 125  | 324      | 112  | 250 | 155 | 202  |   |     |  |     |     |          |     |     |  |  |
|  | 2   | 195   | -19   | 191   | -22   | 193  | -<br>131 | 190  | -60 | 202 | 0  |   |     |  |     |     |          |     |     |  |  |
| 285  | 190   | 282   | 220   | 128   | 230   | 113  | 366      | 207  | 256 | 126 | 212  | 297   | 213 |  |     |     |          |     |     |  |  |
| 206  | 16  | 205   | -15   | 223   | -7  | 213  | -<br>153 | 195  | -61 | 231 | 19   | 213   | 0   |  |     |     |          |     |     |  |  |
| 345  | 178   | 356   | 216   | 177   | 210   | 137  | 326      | 230  | 241 | 139 | 199  | 256   | 207 | 450  | 220 |     |          |     |     |  |  |
| 210  | 32  | 216   | 0   | 201   | -9  | 200  | -<br>126 | 196  | -45 | 211 | 12   | 223   | 16  | 220  | 0   |     |          |     |     |  |  |
| 397  | 186   | 401   | 220   | 195   | 214   | 157  | 336      | 256  | 253 | 155 | 202  | 297   | 213 | 422  | 218 | 504 | 343      |     |     |  |  |
| 339  | 153   | 348   | 128   | 329   | 115   | 369  | 33       | 375  | 122 | 353 | 151  | 358   | 145 | 334  | 116 | 343 | 0        |     |     |  |  |
| 374  | 185   | 376   | 214   | 177   | 205   | 155  | 333      | 256  | 253 | 150 | 199  | 287   | 211 | 360  | 216 | 416 | 348      | 416 | 197 |  |  |
| 187  | 2   | 191   | -23   | 186   | -19   | 189  | -<br>144 | 182  | -71 | 194 | -5   | 199   | -12 | 191  | -25 | 197 | -<br>151 | 197 | 0   |  |  |
| 293  | 190   | 296   | 224   | 140   | 213   | 116  | 353      | 188  | 255 | 117 | 206  | 236   | 218 | 305  | 230 | 347 | 338      | 315 | 208 | 347  | 18   |
| 179  | -11   | 184   | -40   | 186   | -27   | 184  | -<br>169 | 173  | -82 | 189 | -17  | 181   | -37 | 180  | -50 | 186 | -<br>152 | 189 | -19 | 186  | 0  |
| R ME   | EAN   | FOR   | ECA   | ST E  | RRO   | PR (N  | M)       |      | ,   | ,   | ,  | ,   | ,   |  |     |     | ,        | ,   | ,   |  |  |
| JTW  | С   | NGF   | PS  | EGF   | RR  | JAV  | N        | CLIF | )   | CON | ١U   | CON   | 1W  |  |     |     |          |     |     |  |  |
| 242  | 242   |   |   |   |   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 242  | 0   |   |   |   |   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 227  | 239   | 311   | 299   |   |   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 274  | 35  | 299   | 0   |   |   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 114  | 237   | 131   | 275   | 148   | 291   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
| 283  | 46  | 285   | 10  | 291   | 0   |  |          |      |     |     |  |   |     |  |     |     |          |     |     |  |  |
|  | 206<br>345<br>210<br>397<br>339<br>374<br>187<br>293<br>179<br>R ME<br>242<br>242<br>227<br>274<br>114<br>283 | 206   16<br>345   178<br>210   32<br>397   186<br>339   153<br>374   185<br>187   2<br>293   190<br>179   -11<br>R MEAN<br>JTWC<br>242   242<br>242   0<br>227   239<br>274   35<br>114   237<br>283   46 | 206   16   205<br>345   178   356<br>210   32   216<br>397   186   401<br>339   153   348<br>374   185   376<br>187   2   191<br>293   190   296<br>179   -11   184<br>R MEAN FOR<br>JTWC   NGF<br>242   242  <br>242   0<br>227   239   311<br>274   35   299<br>114   237   131<br>283   46   285 | 206   16   205   -15   345   178   356   216   210   32   216   0   397   186   401   220   339   153   348   128   374   185   376   214   187   2   191   -23   293   190   296   224   179   -11   184   -40   R MEAN FORECA   317   317   275   283   46   285   10   10   10   10   10   10   10   1 | 206   16   205   -15   223   245   178   356   216   177   210   32   216   0   201   397   186   401   220   195   339   153   348   128   329   374   185   376   214   177   187   2   191   -23   186   293   190   296   224   140   179   -11   184   -40   186   179   -11   184   -40   186   179   242 | 206   16   205   -15   223   -7   345   178   356   216   177   210   210   32   216   0   201   -9   397   186   401   220   195   214   339   153   348   128   329   115   374   185   376   214   177   205   187   2   191   -23   186   -19   293   190   296   224   140   213   179   -11   184   -40   186   -27   242   24 | 206      | 206  | 206 | 206 | 206   16   205   -15   223   -7   213   153   195   -61   231   2345   178   356   216   177   210   137   326   230   241   139   210   32   216   0   201   -9   200   126   196   -45   211   397   186   401   220   195   214   157   336   256   253   155   339   153   348   128   329   115   369   33   375   122   353   374   185   376   214   177   205   155   333   256   253   150   187   2   191   -23   186   -19   189   144   182   -71   194   293   190   296   224   140   213   116   353   188   255   117   179   -11   184   -40   186   -27   184   169   173   -82   189   R MEAN FORECAST ERROR (NM)  STWC   NGPS   EGRR   JAVN   CLIP   CON   242   242 | 206   16   205   -15   223   -7   213   -153   195   -61   231   19<br>345   178   356   216   177   210   137   326   230   241   139   199<br>210   32   216   0   201   -9   200   -126   196   -45   211   12<br>397   186   401   220   195   214   157   336   256   253   155   202<br>339   153   348   128   329   115   369   33   375   122   353   151<br>374   185   376   214   177   205   155   333   256   253   150   199<br>187   2   191   -23   186   -19   189   -144   182   -71   194   -5<br>293   190   296   224   140   213   116   353   188   255   117   206<br>179   -11   184   -40   186   -27   184   -169   173   -82   189   -17<br>R MEAN FORECAST ERROR (NM)<br>JTWC   NGPS   EGRR   JAVN   CLIP   CONU<br>242   242   0   0   0   0   0   0   0   0   0 | 206 | 210 32 216 0 201 -9 200 - 126 196 -45 211 12 223 16  397 186 401 220 195 214 157 336 256 253 155 202 297 213  339 153 348 128 329 115 369 33 375 122 353 151 358 145  374 185 376 214 177 205 155 333 256 253 150 199 287 211  187 2 191 -23 186 -19 189 - 144 182 -71 194 -5 199 -12  293 190 296 224 140 213 116 353 188 255 117 206 236 218  179 -11 184 -40 186 -27 184 - 169 173 -82 189 -17 181 -37  R MEAN FORECAST ERROR (NM)  3TWC NGPS EGRR JAVN CLIP CONU CONW  242 242 0 | 206 | 206 | 206      | 206 | 206 | 206   16   205   -15   223   -7   213   -15   195   -61   231   19   213   0 | 206   16   205   -15   223   -7   213   153   195   -61   231   19   213   0 |

|                      | 288   | 52   | 293  | 8   | 277                           | 1                             | 290               | 0               |          |            |     |     |     |     |  |  |  |          |  |
|----------------------|---|--|--|---|-------------------------------|-------------------------------|-------------------|-----------------|----------|------------|-----|-----|-----|-----|--|--|--|----------|--|
| CLIP                 | 0   | 0  | 0  | 0   | 0                             | 0                             | 0                 | 0               | 2        | 960        |     |     |     |     |  |  |  |          |  |
|                      | 0   | 0  | 0  | 0   | 0                             | 0                             | 0                 | 0               | 960      | 0          |     |     |     |     |  |  |  |          |  |
| CONU                 | 231   | 240  | 278  | 294                                       | 128                           | 284                           | 264               | 289             | 2        | 960        | 309 | 259 |     |     |  |  |  |          |  |
|                      | 242   | 2  | 259  | -35                                       | 249                           | -35                           | 246               | -43             | 447      | -<br>513   | 259 | 0   |     |     |  |  |  |          |  |
| CONW                 | 164   | 234  | 204  | 304                                       | 90                            | 276                           | 193               | 314             | 0        | 0          | 225 | 264 | 225 | 264 |  |  |  |          |  |
|                      | 238   | 4  | 266  | -38                                       | 251                           | -25                           | 250               | -64             | 0        | 0          | 264 | 0   | 264 | 0   |  |  |  |          |  |
| ITMO                 | JTW   |  | NGF  | PS  | EGF                           | RR                            | JAV               | N               | CON      | <b>N</b> U | CON | 1W  |     |     |  |  |  |          |  |
| 120-HO               |   | 1EAN                                       | I FOI  | REC                                       | AST                           | ERR                           | OR (I             | NM)             |          |            |     |     |     |     |  |  |  |          |  |
| JTWC                 | 176   | 304  |  |   |                               |                               |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
|                      |   |  |  |   |                               |                               |                   |                 | <u> </u> |            |     |     |     |     |  |  |  | <u> </u> |  |
|                      | 304   | 0  |  |   |                               |                               |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
| NGPS                 | 304<br>160  |  | 230  | 403                                       |                               |                               |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
| NGPS                 | 160   | 303  | 230<br>403                                   |   |                               |                               |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
| NGPS<br>EGRR         | 160<br>349  | 303  | 403  | 0   | 102                           | 372                           |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
|                      | 160<br>349<br>78                                    | 303<br>46                                  | 403  | 0<br>360                                  | 102                           |                               |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
|                      | 160<br>349<br>78<br>359                             | 303<br>46<br>310                           | 403<br>87<br>366                             | 0<br>360<br>6                             | 372                           |                               | 261               | 363             |          |            |     |     |     |     |  |  |  |          |  |
| EGRR                 | 160<br>349<br>78<br>359<br>146                      | 303<br>46<br>310<br>49                     | 403<br>87<br>366<br>183                      | 0<br>360<br>6<br>377                      | 372                           | 0<br>366                      |                   |                 |          |            |     |     |     |     |  |  |  |          |  |
| EGRR<br>JAVN         | 160<br>349<br>78<br>359<br>146<br>364               | 303<br>46<br>310<br>49<br>308              | 403<br>87<br>366<br>183<br>367               | 0<br>360<br>6<br>377<br>-10               | 372<br>89<br>348              | 0<br>366                      | 363               | 0               | 224      | 316        |     |     |     |     |  |  |  |          |  |
| EGRR<br>JAVN         | 160<br>349<br>78<br>359<br>146<br>364<br>169        | 303<br>46<br>310<br>49<br>308<br>56        | 403<br>87<br>366<br>183<br>367<br>196        | 0<br>360<br>6<br>377<br>-10<br>370        | 372<br>89<br>348              | 0<br>366<br>-18<br>351        | 363<br>181        | 0<br>355        |          |            |     |     |     |     |  |  |  |          |  |
| EGRR<br>JAVN<br>CONU | 160<br>349<br>78<br>359<br>146<br>364<br>169<br>296 | 303<br>46<br>310<br>49<br>308<br>56<br>296 | 403<br>87<br>366<br>183<br>367<br>196<br>317 | 0<br>360<br>6<br>377<br>-10<br>370<br>-53 | 372<br>89<br>348<br>86<br>293 | 0<br>366<br>-18<br>351<br>-58 | 363<br>181<br>310 | 0<br>355<br>-45 | 316      |            | 158 | 320 |     |     |  |  |  |          |  |

|        |      | Tab   | le 4- | 5 Erro | or Sta | tistic | cs for | · Sele | cted | Obje | ective | Tec | hniqu | es |     |   |
|--------|------|-------|-------|--------|--------|--------|--------|--------|------|------|--------|-----|-------|----|-----|---|
|        |      |       |       |        |        | No     | rth In | dian   | Ocea | ın   |        |     |       |    |     |   |
| 12-HOl | JR M | EAN I | FORE  | CAST   | ERR    | OR (N  | IM)    |        |      |      |        |     |       |    |     |   |
|        | JTW  | 'C    | NGF   | PS     | EGR    | :R     | AFW    | /1     | GFD  | N    | JAVN   |     | CLIP  |    | CON | U |
| JTWC   | 38   | 58    |       |        |        |        |        |        |      |      |        |     |       |    |     |   |
|        | 58   | 0     |       |        |        |        |        |        |      |      |        |     |       |    |     |   |
| NGPS   | 35   | 58    | 63    | 78     |        |        |        |        |      |      |        |     |       |    |     |   |
|        | 67   | 9     | 78    | 0      |        |        |        |        |      |      |        |     |       |    |     |   |
| EGRR   | 11   | 54    | 27    | 82     | 29     | 92     |        |        |      |      |        |     |       |    |     |   |
|        | 68   | 14    | 87    | 5      | 92     | 0      |        |        |      |      |        |     |       |    |     |   |
|        |      |       |       |        | -      |        |        |        |      |      |        |     |       |    |     |   |

|      | 59 | -6 | 75  | 4   | 74  | -5  | 72 | 0  |    |     |     |     |    |    |    |    |
|------|----|----|-----|-----|-----|-----|----|----|----|-----|-----|-----|----|----|----|----|
| GFDN | 18 | 55 | 22  | 69  | 0   | 0   | 0  | 0  | 22 | 63  |     |     |    |    |    |    |
|      | 62 | 7  | 63  | -6  | 0   | 0   | 0  | 0  | 63 | 0   |     |     |    |    |    |    |
| JAVN | 0  | 0  | 1   | 130 | 1   | 224 | 0  | 0  | 0  | 0   | 1   | 155 |    |    |    |    |
|      | 0  | 0  | 155 | 25  | 155 | -69 | 0  | 0  | 0  | 0   | 155 | 0   |    |    |    |    |
| CLIP | 38 | 58 | 61  | 76  | 28  | 91  | 21 | 70 | 22 | 63  | 1   | 155 | 73 | 72 |    |    |
|      | 70 | 12 | 72  | -4  | 74  | -17 | 81 | 11 | 61 | -2  | 121 | -34 | 72 | 0  |    |    |
| CONW | 17 | 60 | 24  | 78  | 11  | 62  | 8  | 58 | 7  | 56  | 0   | 0   | 27 | 71 | 27 | 68 |
|      | 59 | -1 | 69  | -9  | 70  | 8   | 72 | 14 | 36 | -20 | 0   | 0   | 68 | -3 | 68 | 0  |

#### 24-HOUR MEAN FORECAST ERROR (NM)

|      | JTW | C   | NGP | S   | EGR | R    | AFW | 1   | GFDI | Ν   | JAVN | 1   | CLIP |     | CON | U   |
|------|-----|-----|-----|-----|-----|------|-----|-----|------|-----|------|-----|------|-----|-----|-----|
| JTWC | 36  | 107 |     |     |     |      |     |     |      |     |      |     |      |     |     |     |
|      | 107 | 0   |     |     |     |      |     |     |      |     |      |     |      |     |     |     |
| NGPS | 32  | 106 | 57  | 112 |     |      |     |     |      |     |      |     |      |     |     |     |
|      | 105 | -1  | 112 | 0   |     |      |     |     |      |     |      |     |      |     |     |     |
| EGRR | 11  | 96  | 27  | 116 | 29  | 120  |     |     |      |     |      |     |      |     |     |     |
|      | 108 | 12  | 120 | 4   | 120 | 0    |     |     |      |     |      |     |      |     |     |     |
| AFW1 | 7   | 128 | 19  | 100 | 18  | 121  | 20  | 103 |      |     |      |     |      |     |     |     |
|      | 108 | -20 | 98  | -2  | 104 | -17  | 103 | 0   |      |     |      |     |      |     |     |     |
| GFDN | 15  | 100 | 18  | 84  | 0   | 0    | 0   | 0   | 19   | 108 |      |     |      |     |     |     |
|      | 108 | 8   | 108 | 24  | 0   | 0    | 0   | 0   | 108  | 0   |      |     |      |     |     |     |
| JAVN | 0   | 0   | 1   | 107 | 1   | 220  | 0   | 0   | 0    | 0   | 1    | 114 |      |     |     |     |
|      | 0   | 0   | 114 | 7   | 114 | -106 | 0   | 0   | 0    | 0   | 114  | 0   |      |     |     |     |
| CLIP | 36  | 107 | 55  | 109 | 28  | 119  | 19  | 104 | 19   | 108 | 1    | 114 | 69   | 134 |     |     |
|      | 142 | 35  | 134 | 25  | 133 | 14   | 161 | 57  | 128  | 20  | 123  | 9   | 134  | 0   |     |     |
| CONW | 16  | 116 | 22  | 126 | 11  | 75   | 7   | 108 | 5    | 87  | 0    | 0   | 25   | 135 | 25  | 129 |
|      | 124 | 8   | 129 | 3   | 130 | 55   | 137 | 29  | 76   | -11 | 0    | 0   | 129  | -6  | 129 | 0   |

|      | JTW | С   | NGP | S   | EGR | R   | AFW | 1   | GFDI | V | JAVN | 1 | CLIP | CON | U |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|---|------|---|------|-----|---|
| JTWC | 33  | 154 |     |     |     |     |     |     |      |   |      |   |      |     |   |
|      | 154 | 0   |     |     |     |     |     |     |      |   |      |   |      |     |   |
| NGPS | 30  | 154 | 54  | 148 |     |     |     |     |      |   |      |   |      |     |   |
|      | 145 | -9  | 148 | 0   |     |     |     |     |      |   |      |   |      |     |   |
| EGRR | 11  | 144 | 26  | 148 | 27  | 160 |     |     |      |   |      |   |      |     |   |
|      | 141 | -3  | 160 | 12  | 160 | 0   |     |     |      |   |      |   |      |     |   |
| AFW1 | 7   | 188 | 18  | 145 | 16  | 169 | 18  | 128 |      |   |      |   |      |     |   |
|      | 166 | -22 | 128 | -17 | 129 | -40 | 128 | 0   |      |   |      |   |      |     |   |

| GFDN   | 14    | 140   | 17  | 111  | 0    | 0     | 0   | 0   | 18  | 153 |      |     |      |     |     |     |
|--------|-------|-------|-----|------|------|-------|-----|-----|-----|-----|------|-----|------|-----|-----|-----|
|        | 164   | 24    | 155 | 44   | 0    | 0     | 0   | 0   | 153 | 0   |      |     |      |     |     |     |
| JAVN   | 0     | 0     | 1   | 118  | 1    | 167   | 0   | 0   | 0   | 0   | 1    | 110 |      |     |     |     |
|        | 0     | 0     | 110 | -8   | 110  | -57   | 0   | 0   | 0   | 0   | 110  | 0   |      |     |     |     |
| CLIP   | 33    | 154   | 52  | 144  | 26   | 160   | 17  | 135 | 18  | 153 | 1    | 110 | 65   | 192 |     |     |
|        | 210   | 56    | 196 | 52   | 197  | 37    | 244 | 109 | 186 | 33  | 108  | -2  | 192  | 0   |     |     |
| CONW   | 15    | 180   | 20  | 170  | 10   | 130   | 6   | 176 | 4   | 139 | 0    | 0   | 23   | 206 | 23  | 195 |
|        | 190   | 10    | 195 | 25   | 200  | 70    | 217 | 41  | 119 | -20 | 0    | 0   | 195  | -11 | 195 | 0   |
| 48-HOL | JR ME | EAN F | ORE | CAST | ERRO | OR (N | M)  |     |     |     |      |     |      |     |     |     |
|        | JTW   | C     | NGP |      | EGR  | R     | AFW | 1   | GFD | N   | JAVN | 1   | CLIP | 1   | CON | U   |
| JTWC   | 30    | 192   |     |      |      |       |     |     |     |     |      |     |      |     |     |     |
|        | 192   | 0     |     |      |      |       |     |     |     |     |      |     |      |     |     |     |
| NGPS   | 28    | 196   | 51  | 191  |      |       |     |     |     |     |      |     |      |     |     |     |
|        | 188   | -8    | 191 | 0    |      |       |     |     |     |     |      |     |      |     |     |     |
| EGRR   | 11    | 190   | 24  | 184  | 25   | 184   |     |     |     |     |      |     |      |     |     |     |
|        | 162   | -28   | 188 | 4    | 184  | 0     |     |     |     |     |      |     |      |     |     |     |
| AFW1   | 6     | 223   | 16  | 180  | 14   | 208   | 16  | 184 |     |     |      |     |      |     |     |     |
|        | 175   | -48   | 184 | 4    | 185  | -23   | 184 | 0   |     |     |      |     |      |     |     |     |
| GFDN   | 13    | 180   | 16  | 157  | 0    | 0     | 0   | 0   | 16  | 199 |      |     |      |     |     |     |
|        | 210   | 30    | 199 | 42   | 0    | 0     | 0   | 0   | 199 | 0   |      |     |      |     |     |     |
| JAVN   | 0     | 0     | 1   | 124  | 1    | 43    | 0   | 0   | 0   | 0   | 1    | 124 |      |     |     |     |
|        | 0     | 0     | 124 | 0    | 124  | 81    | 0   | 0   | 0   | 0   | 124  | 0   |      |     |     |     |
| CLIP   | 30    | 192   | 50  | 185  | 25   | 184   | 16  | 184 | 16  | 199 | 1    | 124 | 62   | 260 |     |     |
|        | 280   | 88    | 264 | 79   | 264  | 80    | 334 | 150 | 267 | 68  | 77   | -47 | 260  | 0   |     |     |
| CONW   | 12    | 223   | 18  | 229  | 9    | 181   | 5   | 228 | 3   | 172 | 0    | 0   | 21   | 295 | 21  | 263 |
|        | 234   | 11    | 263 | 34   | 249  | 68    | 308 | 80  | 185 | 13  | 0    | 0   | 263  | -32 | 263 | 0   |
| 72-HOl |       |       | 1   |      |      |       | ,   |     |     |     |      |     | 1    |     | 1   |     |
|        | JTW   |       | NGP | S    | EGR  | R     | AFW | 1   | GFD | N   | JAVI | 1   | CLIP |     | CON | U   |
| JTWC   | 6     | 338   |     |      |      |       |     |     |     |     |      |     |      |     |     |     |
|        | 338   | 0     |     |      |      |       |     |     |     |     |      |     |      |     |     |     |
| NGPS   | 5     | 348   | 43  | 278  |      |       |     |     |     |     |      |     |      |     |     |     |
|        | 417   | 69    | 278 | 0    |      |       |     |     |     |     |      |     |      |     |     |     |
| EGRR   | 0     | 0     | 14  | 222  | 16   | 224   |     |     |     |     |      |     |      |     |     |     |
|        | 0     | 0     | 239 | 17   | 224  | 0     |     |     |     |     |      |     |      |     |     |     |
| AFW1   | 2     | 349   | 13  | 299  | 7    | 293   | 13  | 195 |     |     |      |     |      |     |     |     |
|        | 95 -  | 254   | 195 | -104 |      | -31   | 195 | 0   |     |     |      |     |      |     |     |     |
| GFDN   | 2     | 292   | 14  | 243  | 0    | 0     | 0   | 0   | 14  | 283 |      |     |      |     |     |     |

|      | 384 | 92  | 283 | 40  | 0   | 0   | 0   | 0   | 283 | 0   |     |     |     |      |     |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|
| JAVN | 0   | 0   | 1   | 270 | 1   | 145 | 0   | 0   | 0   | 0   | 1   | 276 |     |      |     |     |
|      | 0   | 0   | 276 | 6   | 276 | 131 | 0   | 0   | 0   | 0   | 276 | 0   |     |      |     |     |
| CLIP | 6   | 338 | 42  | 276 | 16  | 224 | 13  | 195 | 14  | 283 | 1   | 276 | 54  | 416  |     |     |
|      | 610 | 272 | 425 | 149 | 349 | 125 | 536 | 341 | 386 | 103 | 229 | -47 | 416 | 0    |     |     |
| CONW | 6   | 338 | 13  | 390 | 2   | 195 | 4   | 85  | 2   | 384 | 0   | 0   | 16  | 593  | 16  | 453 |
|      | 411 | 73  | 461 | 71  | 270 | 75  | 650 | 565 | 369 | -15 | 0   | 0   | 453 | -140 | 453 | 0   |

## Table 4-6

## **Error Statistics for Selected Objective Techniques Southern Hemisphere**

|      | JTW | С  | NGP | S   | EGR | R         | AFW | /1       | GFD | N  | JAVI | ٧   | TCLI | Р  | TLAI | >        | CLIF | )   | CON | IW |
|------|-----|----|-----|-----|-----|-----------|-----|----------|-----|----|------|-----|------|----|------|----------|------|-----|-----|----|
| JTWC | 311 | 45 |     |     |     |           |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
|      | 45  | 0  |     |     |     |           |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
| NGPS | 283 | 43 | 563 | 63  |     |           |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
|      | 54  | 11 | 63  | 0   |     |           |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
| EGRR | 162 | 40 | 253 | 58  | 302 | 80        |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
|      | 54  | 14 | 75  | 17  | 80  | 0         |     |          |     |    |      |     |      |    |      |          |      |     |     |    |
| AFW1 | 124 | 37 | 167 | 48  | 167 | 54        | 179 | 108      |     |    |      |     |      |    |      |          |      |     |     |    |
|      | 100 | 63 | 104 | 56  | 103 | 49        | 108 | 0        |     |    |      |     |      |    |      |          |      |     |     |    |
| GFDN | 100 | 47 | 211 | 53  | 3   | 1568      | 0   | 0        | 214 | 48 |      |     |      |    |      |          |      |     |     |    |
|      | 51  | 4  | 47  | -6  | 66  | -<br>1502 | 0   | 0        | 48  | 0  |      |     |      |    |      |          |      |     |     |    |
| JAVN | 230 | 43 | 418 | 62  | 162 | 83        | 107 | 115      | 195 | 47 | 523  | 89  |      |    |      |          |      |     |     |    |
|      | 74  | 31 | 78  | 16  | 76  | -7        | 73  | -42      | 67  | 20 | 89   | 0   |      |    |      |          |      |     |     |    |
| TCLP | 61  | 38 | 82  | 50  | 81  | 53        | 65  | 107      | 1   | 30 | 53   | 75  | 87   | 79 |      |          |      |     |     |    |
|      | 78  | 40 | 79  | 29  | 81  | 28        | 81  | -26      | 104 | 74 | 91   | 16  | 79   | 0  |      |          |      |     |     |    |
| TLAP | 62  | 38 | 84  | 50  | 84  | 53        | 68  | 107      | 1   | 30 | 52   | 74  | 77   | 80 | 89   | 137      |      |     |     |    |
|      | 137 | 99 | 138 | 88  | 139 | 86        | 144 | 37       | 76  | 46 | 138  | 64  | 128  | 48 | 137  | 0        |      |     |     |    |
| CLIP | 309 | 45 | 555 | 63  | 286 | 78        | 174 | 105      | 212 | 48 | 484  | 84  | 86   | 79 | 88   | 137      | 690  | 191 |     |    |
|      | 124 | 79 | 157 | 94  | 133 | 55        | 72  | -33      | 114 | 66 | 187  | 103 | 128  | 49 | 118  | -19      | 191  | 0   |     |    |
| CONW | 8   | 41 | 12  | 67  | 7   | 94        | 5   | 228      | 3   | 17 | 15   | 159 | 3    | 45 | 3    | 163      | 17   | 123 | 17  | 51 |
|      | 48  | 7  | 56  | -11 | 45  | -49       | 58  | -<br>170 | 35  | 18 | 52 - | 107 | 61   | 16 | 61   | -<br>102 | 51   | -72 | 51  | 0  |

#### 24-HOUR MEAN FORECAST ERROR (NM)

|      | JTW | С   | NGP | S   | EGR | R         | AFW | ′1       | GFD | N  | JAVI | V   | TCLI | Р   | TLAI | Р        | CLIF | )    | CON | 1W |
|------|-----|-----|-----|-----|-----|-----------|-----|----------|-----|----|------|-----|------|-----|------|----------|------|------|-----|----|
| JTWC | 278 | 74  |     |     |     |           |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
|      | 74  | 0   |     |     |     |           |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
| NGPS | 258 | 73  | 526 | 95  |     |           |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
|      | 82  | 9   | 95  | 0   |     |           |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
| EGRR | 150 | 65  | 239 | 90  | 287 | 111       |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
|      | 87  | 22  | 108 | 18  | 111 | 0         |     |          |     |    |      |     |      |     |      |          |      |      |     |    |
| AFW1 | 115 | 63  | 156 | 79  | 156 | 87        | 168 | 134      |     |    |      |     |      |     |      |          |      |      |     |    |
|      | 120 | 57  | 128 | 49  | 128 | 41        | 134 | 0        |     |    |      |     |      |     |      |          |      |      |     |    |
| GFDN | 92  | 83  | 195 | 83  | 3   | 1606      | 0   | 0        | 198 | 78 |      |     |      |     |      |          |      |      |     |    |
|      | 87  | 4   | 78  | -5  | 132 | -<br>1474 | 0   | 0        | 78  | 0  |      |     |      |     |      |          |      |      |     |    |
| JAVN | 209 | 72  | 386 | 94  | 155 | 109       | 101 | 138      | 181 | 79 | 489  | 127 |      |     |      |          |      |      |     |    |
|      | 105 | 33  | 115 | 21  | 112 | 3         | 101 | -37      | 100 | 21 | 127  | 0   |      |     |      |          |      |      |     |    |
| TCLP | 58  | 65  | 76  | 81  | 76  | 83        | 58  | 122      | 1   | 6  | 50   | 110 | 81   | 123 |      |          |      |      |     |    |
|      | 115 | 50  | 122 | 41  | 127 | 44        | 110 | -12      | 39  | 33 | 129  | 19  | 123  | 0   |      |          |      |      |     |    |
| TLAP | 58  | 64  | 77  | 80  | 78  | 83        | 61  | 123      | 1   | 6  | 48   | 101 | 71   | 123 | 82   | 192      |      |      |     |    |
|      | 188 | 124 | 185 | 105 | 196 | 113       | 194 | 71       | 30  | 24 | 224  | 123 | 182  | 59  | 192  | 0        |      |      |     |    |
| CLIP | 276 | 75  | 518 | 95  | 271 | 110       | 163 | 129      | 196 | 78 | 452  | 121 | 80   | 122 | 81   | 193      | 646  | 240  |     |    |
|      | 172 | 97  | 207 | 112 | 180 | 70        | 120 | -9       | 160 | 82 | 226  | 105 | 183  | 61  | 172  | -21      | 240  | 0    |     |    |
| CONW | 7   | 79  | 10  | 99  | 7   | 140       | 4   | 260      | 3   | 18 | 13   | 236 | 2    | 37  | 2    | 635      | 15   | 234  | 15  | 82 |
|      | 83  | 4   | 89  | -10 | 80  | -60       | 84  | -<br>176 | 54  | 36 | 83 - | 153 | 78   | 41  | 78   | -<br>557 | 82   | -152 | 82  | 0  |

|      | JTW | С   | NGP | S   | EGR | R    | AFW | <b>′</b> 1 | GFD | N   | JAVI | V   | TCLI | > | TLA | > | CLIP | • | CON | IW |
|------|-----|-----|-----|-----|-----|------|-----|------------|-----|-----|------|-----|------|---|-----|---|------|---|-----|----|
| JTWC | 250 | 101 |     |     |     |      |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
|      | 101 | 0   |     |     |     |      |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
| NGPS | 232 | 99  | 484 | 127 |     |      |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
|      | 110 | 11  | 127 | 0   |     |      |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
| EGRR | 134 | 89  | 217 | 123 | 262 | 126  |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
|      | 119 | 30  | 122 | -1  | 126 | 0    |     |            |     |     |      |     |      |   |     |   |      |   |     |    |
| AFW1 | 100 | 86  | 137 | 112 | 135 | 119  | 148 | 165        |     |     |      |     |      |   |     |   |      |   |     |    |
|      | 146 | 60  | 157 | 45  | 157 | 38   | 165 | 0          |     |     |      |     |      |   |     |   |      |   |     |    |
| GFDN | 81  | 111 | 177 | 114 | 1   | 230  | 0   | 0          | 179 | 109 |      |     |      |   |     |   |      |   |     |    |
|      | 121 | 10  | 109 | -5  | 18  | -212 | 0   | 0          | 109 | 0   |      |     |      |   |     |   |      |   |     |    |
| JAVN | 186 | 102 | 347 | 123 | 138 | 111  | 89  | 158        | 160 | 110 | 444  | 162 |      |   |     |   |      |   |     |    |

| 4.2 TESTI | ING AN    | ND RES    | SULTS      |           |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
|-----------|-----------|-----------|------------|-----------|-------|-------|-----|----------|------------|-----|----------|-----|-----|----------|----------|----------|----------|------|-----|-----|
|           | 133       | 31        | 149        | 26        | 149   | 38    | 142 | -16      | 120        | 10  | 162      | 0   |     |          |          |          |          |      |     |     |
| TCLP      | 53        | 94        | 69         | 116       | 67    | 115   | 51  | 146      | 1          | 12  | 44       | 162 | 73  | 152      |          |          |          |      |     |     |
|           | 148       | 54        | 153        | 37        | 157   | 42    | 148 | 2        | 18         | 6   | 158      | -4  | 152 | 0        |          |          |          |      |     |     |
| TLAP      | 53        | 89        | 70         | 111       | 69    | 116   | 53  | 139      | 1          | 12  | 44       | 160 | 63  | 149      | 74       | 244      |          |      |     |     |
|           | 239       | 150       | 237        | 126       | 248   | 132   | 235 | 96       | 55         | 43  | 300      | 140 | 216 | 67       | 244      | 0        |          |      |     |     |
| CLIP      | 249       | 101       | 479        | 127       | 247   | 125   | 143 | 159      | 179        | 109 | 412      | 153 | 72  | 152      | 73       | 245      | 602      | 332  |     |     |
|           | 232       | 131       | 295        | 168       | 249   | 124   | 170 | 11       | 220        | 111 | 323      | 170 | 236 | 84       | 218      | -27      | 332      | 0    |     |     |
| CONW      | 6         | 122       | 8          | 146       | 6     | 182   | 3   | 267      | 3          | 29  | 10       | 262 | 2   | 73       | 2        | 646      | 13       | 338  | 13  | 120 |
|           | 117       | -5        | 131        | -15       | 109   | -73   | 115 | -<br>152 | 80         | 51  | 120      | 142 | 141 | 68       | 141      | -<br>505 | 120      | -218 | 120 | 0   |
| 48-HOL    |           |           |            |           | T ERI | ROR ( | NM) |          | 4.         |     | 4        |     |     |          |          |          | 4        |      |     |     |
|           |           |           |            |           |       |       |     |          |            | CON | IW       |     |     |          |          |          |          |      |     |     |
| JTWC      |           |           |            |           |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
|           | 128       |           |            | . = 0     |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
| NGPS      | 204       | 124       |            | 156       |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
| = 200     | 137       | 13        |            | 0         |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
| EGRR      | 121       | 114       | 196        | 152       | 238   | 160   |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
| A []\A/4  |           | 36        | 155        | 3         |       | 0     | 407 | 040      |            |     |          |     |     |          |          |          |          |      |     |     |
| AFW1      | 86        | 117       | 116        | 140       | 116   |       | 127 | 212      |            |     |          |     |     |          |          |          |          |      |     |     |
| GFDN      | 183<br>69 | 66        |            | 63        | 197   |       | 212 | 0        | 150        | 112 |          |     |     |          |          |          |          |      |     |     |
| GFDIN     |           | 135<br>14 | 157<br>142 | 147       | 78    | 288   |     | 0        | 159<br>142 |     |          |     |     |          |          |          |          |      |     |     |
| JAVN      | 164       |           | 315        | -5<br>155 | 125   | 143   | 79  | 200      | 144        | 141 | 408      | 198 |     |          |          |          |          |      |     |     |
| JAVIN     |           | 31        | 184        | 29        | 178   |       | 176 | -24      | 157        | 16  |          | 0   |     |          |          |          |          |      |     |     |
| TCLP      | 49        | 115       | 61         | 151       | 60    | 143   | 45  | 175      | 1          | 12  | 38       | 172 | 65  | 185      |          |          |          |      |     |     |
| TOLI      |           | 69        | 187        | 36        |       |       | 170 | -5       | 24         | 12  |          | 37  | 185 | 0        |          |          |          |      |     |     |
| TLAP      | 48        | 110       |            | 138       | 58    | 136   | 44  | 164      | 1          | 12  | 36       | 169 |     | 180      | 63       | 289      |          |      |     |     |
| ,         | 289       |           | 284        | 146       | 284   | 148   | 267 | 103      |            |     | 357      | 188 | 290 |          | 289      | 0        |          |      |     |     |
| CLIP      | 219       |           |            |           | 224   | 160   | 122 | 205      | 159        |     | 379      | 191 | 64  | 185      | 62       | 291      | 552      | 450  |     |     |
|           | 277       |           | 390        |           | 325   |       | 225 | 20       | 274        | 132 |          |     |     | 95       | 266      | -25      | 450      |      |     |     |
| CONW      | 5         | 148       | 6          | 164       | 5     | 276   | 2   | 472      | 3          | 55  | 8        | 319 | 1   | 67       | 1        | 901      | 11       | 572  | 11  | 148 |
|           | 157       | 9         | 151        | -13       | 134   | -142  | 102 | -<br>370 | 116        | 61  | 143      | 176 | 84  | 17       | 84       | -<br>817 | 148      | -424 | 148 | 0   |
| 72-HOL    | JR M      | EAN I     | FORE       | ECAS      | T ERI | ROR ( | NM) | 1        | J          | 1   | <u> </u> |     |     | <u> </u> | <u> </u> | <u> </u> | <u> </u> | J    |     |     |
|           | JTW       |           |            |           |       |       |     |          |            |     | CON      | IW  |     |          |          |          |          |      |     |     |
| JTWC      | 37        | 123       |            |           |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |
|           | 123       | 0         |            |           |       |       |     |          |            |     |          |     |     |          |          |          |          |      |     |     |

| 4.2 TEST | ING A | ND RES | SULTS |     |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|----------|-------|--------|-------|-----|------|-------|------|-----|------|----------|----------|-----|-----|-----|-----|-----|-----|------|-----|-----|
| NGPS     | 37    | 123    | 357   | 222 |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 135   | 12     | 222   | 0   |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
| EGRR     | 17    | 113    | 152   | 223 | 194  | 212   |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 170   | 57     | 203   | -20 | 212  | 0     |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
| AFW1     | 8     | 91     | 83    | 219 | 84   | 197   | 93   | 290 |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 107   | 16     | 278   | 59  | 274  | 77    | 290  | 0   |      |          |          |     |     |     |     |     |     |      |     |     |
| GFDN     | 15    | 132    | 123   | 201 | 1    | 581   | 0    | 0   | 125  | 220      |          |     |     |     |     |     |     |      |     |     |
|          | 207   | 75     | 219   | 18  | 98   | -483  | 0    | 0   | 220  | 0        |          |     |     |     |     |     |     |      |     |     |
| JAVN     | 32    | 130    | 249   | 214 | 102  | 192   | 57   | 274 | 111  | 223      | 334      | 260 |     |     |     |     |     |      |     |     |
|          | 206   | 76     | 240   | 26  | 234  | 42    | 230  | -44 | 211  | -12      | 260      | 0   |     |     |     |     |     |      |     |     |
| TCLP     | 10    | 91     | 48    | 235 | 47   | 200   | 34   | 225 | 1    | 57       | 28       | 250 | 50  | 216 |     |     |     |      |     |     |
|          | 171   | 80     | 211   | -24 | 214  | 14    | 172  | -53 | 86   | 29       | 232      | -18 | 216 | 0   |     |     |     |      |     |     |
| TLAP     | 9     | 86     | 46    | 209 | 45   | 202   | 33   | 204 | 1    | 57       | 28       | 224 | 44  | 218 | 48  | 336 |     |      |     |     |
|          | 219   | 133    | 337   | 128 | 342  | 140   | 262  | 58  | 142  | 85       | 402      | 178 | 331 | 113 | 336 | 0   |     |      |     |     |
| CLIP     | 37    | 123    | 350   | 221 | 181  | 210   | 88   | 280 | 124  | 222      | 308      | 252 | 48  | 218 | 46  | 337 | 459 | 633  |     |     |
|          | 248   | 125    | 541   | 320 | 464  | 254   | 332  | 52  | 342  | 120      | 590      | 338 | 386 | 168 | 365 | 28  | 633 | 0    |     |     |
| CONW     | 0     | 0      | 3     | 142 | 3    | 473   | 0    | 0   | 2    | 67       | 4        | 412 | 0   | 0   | 0   | 0   | 6   | 1048 | 7   | 219 |
|          | 0     | 0      | 190   | 48  | 214  | -259  | 0    | 0   | 187  | 120      | 196<br>- | 216 | 0   | 0   | 0   | 0   | 225 | -823 | 219 | 0   |
| 96-HOI   | JR M  | EAN I  | FORE  | CAS | TER  | ROR ( | NM)  | ,   | ,    | ,        | ,        | ,   | ,   | ,   | ,   | ,   | ,   | ,    |     |     |
|          | NGF   | PS     | EGR   | R.  | JAVI | N     | TCLI | D . | TLAI | <b>D</b> |          |     |     |     |     |     |     |      |     |     |
| NGPS     | 274   | 288    |       |     |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 288   | 0      |       |     |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
| EGRR     | 106   | 283    | 141   | 260 |      |       |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 243   | -40    | 260   | 0   |      |       |      |     | )    |          | )        |     |     |     |     |     |     |      |     |     |
| JAVN     | 186   | 282    | 74    | 244 | 259  | 327   |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 303   | 21     | 293   | 49  | 327  | 0     |      |     |      |          |          |     |     |     |     |     |     |      |     |     |
| TCLP     | 0     | 0      | 0     | 0   | 0    | 0     | 1    | 303 |      |          |          |     |     |     |     |     |     |      |     |     |
|          | 0     | 0      | 0     | 0   | 0    | 0     | 303  | 0   |      |          |          |     |     |     |     |     |     |      |     |     |
| TLAP     | 0     | 0      | 0     | 0   | 0    | 0     | 1    | 303 | 1    | 334      |          |     |     |     |     |     |     |      |     |     |

## 120-HOUR MEAN FORECAST ERROR (NM)

0

334 31

0

0

|      | NGP | S   | EGR | R   | JAVI | 1 | TCLF | ) | TLAF | ) |  |  |  |  |  |
|------|-----|-----|-----|-----|------|---|------|---|------|---|--|--|--|--|--|
| NGPS | 206 | 347 |     |     |      |   |      |   |      |   |  |  |  |  |  |
|      | 347 | 0   |     |     |      |   |      |   |      |   |  |  |  |  |  |
| EGRR | 69  | 340 | 90  | 260 |      |   |      |   |      |   |  |  |  |  |  |
|      | 274 | -66 | 260 | 0   |      |   |      |   |      |   |  |  |  |  |  |

334 0

#### 4.2 TESTING AND RESULTS

|      | ,   | ,   |     | ,   |     |     |     | ,   |     |     |  |  | <br> |  |  |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|------|--|--|
| JAVN | 130 | 348 | 48  | 268 | 176 | 384 |     |     |     |     |  |  |      |  |  |
|      | 362 | 14  | 361 | 93  | 384 | 0   |     |     |     |     |  |  |      |  |  |
| TCLP | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 459 |     |     |  |  |      |  |  |
|      | 0   | 0   | 0   | 0   | 0   | 0   | 459 | 0   |     |     |  |  |      |  |  |
| TLAP | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 459 | 1   | 463 |  |  |      |  |  |
|      | 0   | 0   | 0   | 0   | 0   | 0   | 463 | 4   | 463 | 0   |  |  |      |  |  |